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LAND AIR WATER

Volume 64
Number 26

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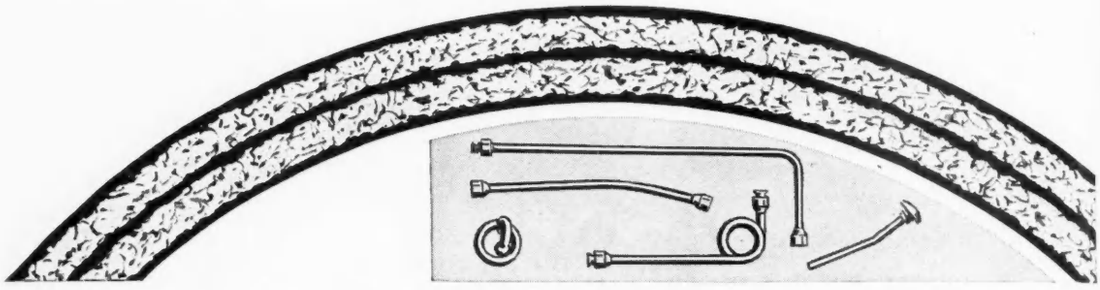

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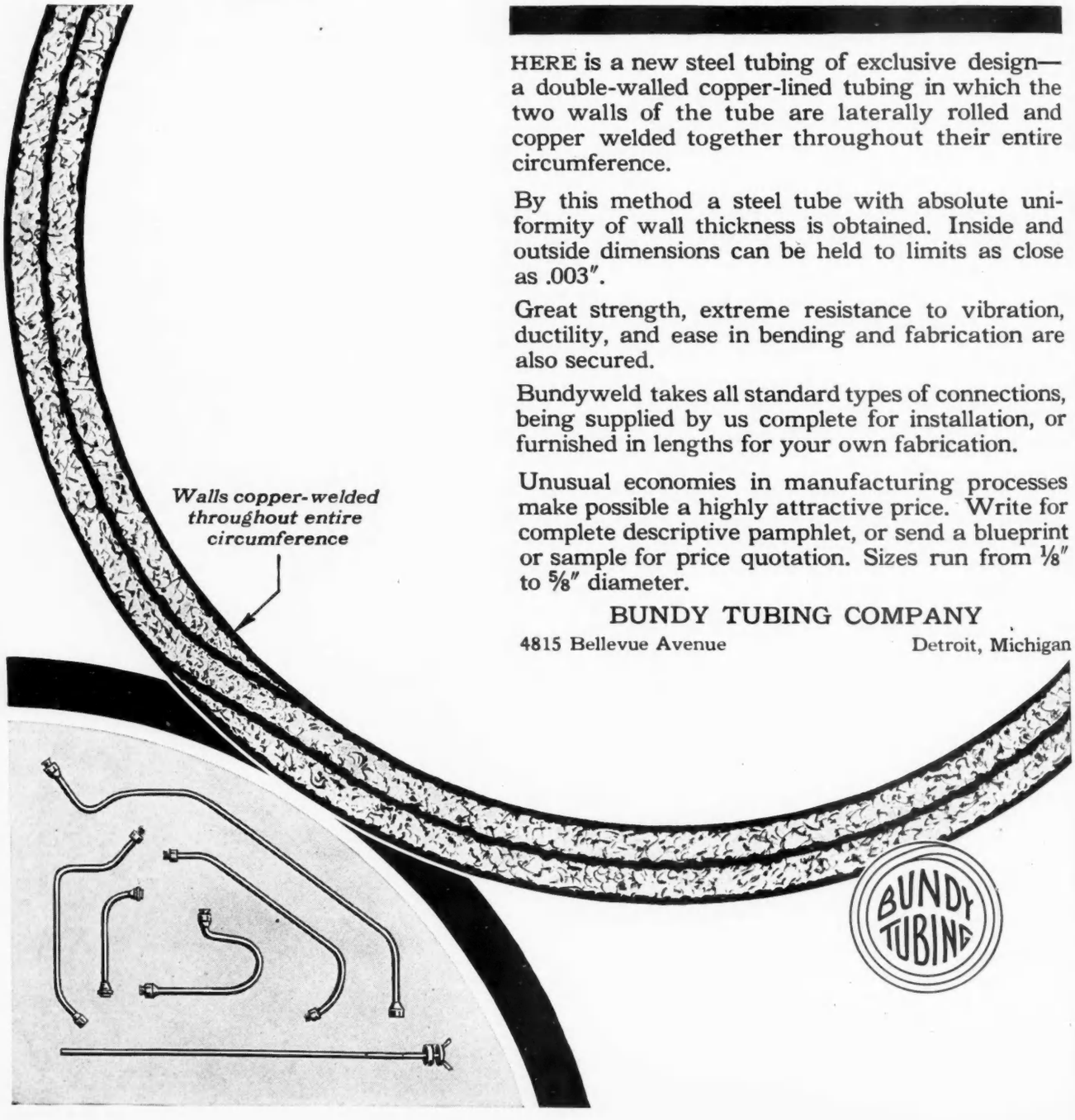


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Vol. 64 No. 26



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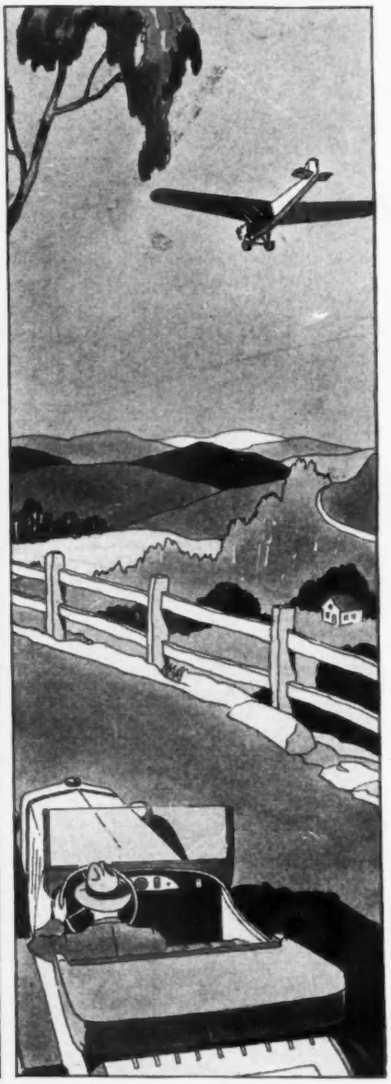

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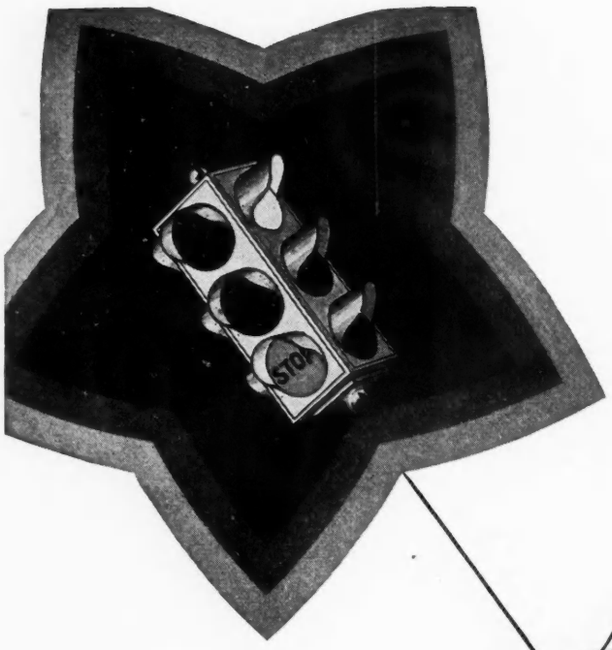


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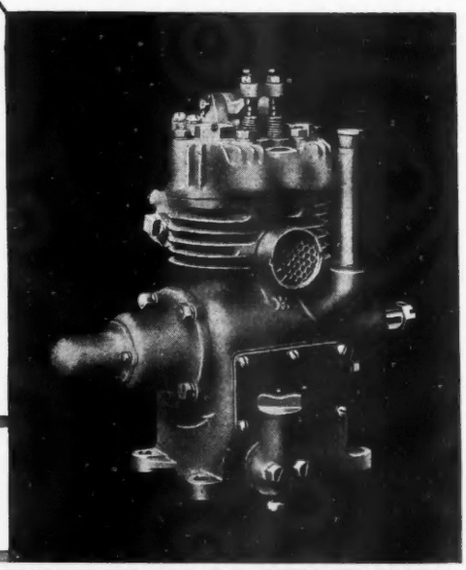

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AUTOMOTIVE INDUSTRIES

VOLUME 64 JUNE 27, 1931 NUMBER 26

# Engineers and Technologists Clash in Heated S. A. E. Sessions

by Leslie Peat

HEARTY approval was given the fine Summer Meeting program of the Society of Automotive Engineers by the members who attended the White Sulphur Springs session during the week of June 14. This approval was demonstrated by the enthusiastic discussions which added wealth to the engineering literature of the industry.

The following pages record the high-spots of the discussions and abstracts of the able papers presented. Here are the divergent opinions of body designers and chassis engineers; here fuel technologists take issue with engine engineers. Questions of ultra-high speed of cars are approached from engineering and owner angles, and rear-engine mounting, a subject treated at length in a recent series of articles in *Automotive Industries*, brought some of the most important engineering executives in the industry to their feet.

Although the attendence was not as large as was expected, the keenest thinkers in the business were present. Although the session was the longest ever held, most of those who attended the meeting stayed through the last day.

The weather was excellent; so fine, in fact, that the lure of the golf links was felt at several sessions.

Arthur J. Scaife, consulting field engineer of the White Co., Cleveland, was nominated president to take office at the annual meeting next January. He will be assisted by an able group of vice-presidents and councillors whose nominations were reported in *Automotive Industries* last week. (Mr. Scaife shown at right.)

A great deal of interest was evidenced in the announcement that the research committee of the Society approved the idea of the appointment of a sub-committee to determine the lubrication requirements of gears and bearings, and then to develop tests to evaluate the properties and requirements of extreme pressure lubricants.

This time-honored problem is becoming increasingly serious as with the introduction of hypoid and other types of high-pressure gears.* Refiners throughout the country have been working on some of these problems, but it is felt that there should be some program to correlate the findings made and to steer further research along those channels which would best serve the needs of the industry.

The groups which are proposed to interest them-

* "Hypoid Gear Lubrication," by W. C. Bauer, *Automotive Industries*, June 13.

# S. A. E. Officers Nominated for 1932

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selves in this research program represent refiners, manufacturers of axles, trucks, passenger cars, bearings and operators of fleets.

Hon. David S. Ingalls was the speaker at the general aircraft session Wednesday. He told of aircraft development in the defense and offensive Navy programs with the use of motion pictures.

Harry L. Horning, president, Waukesha Motor Co., struck a new note in his discussion of employment problems in the industry when he spoke on labor turnover at the production session Thursday evening.

"Zero turnover in itself is no virtue. Turnover often weeds out men who have been allowed to decay, or who have not been supplying the initiative and force which all organizations need—especially during the stress of hard times.

"A technical man, improperly placed, can lose more for a company by his errors of omission or commission than all the other employees combined."

## Detonation Sub-committee, Cooperative Fuel Research Committee

Seated, left to right: J. P. Stewart, Vacuum Oil Co.; Neil McCoull, Thomas A. Boyd, fuels section, General Motors Research, chairman; Dr. H. C. Dickinson, Bureau of Standards; Harry L. Horning, president, Waukesha Motor Co.; C. B. Veal, secretary; O. C. Bridgeman, Bureau of Standards; Donald B. Brooks, Miss Wamsley, S.A.E. staff, and Miss E. W. Aldrich, Bureau of Standards

Standing: Lester C. Lichty, Yale University; E. E. Sanborn, C. B. Bishop, Bureau of Standards; J. C. Geniesse, Atlantic Refining Co.; H. K. Cummings, Bureau of Standards; Graham Edgar, Ethyl Gasoline Corp.; A. L. Beall, Vacuum Oil Co.; Arman E. Becker, Standard Oil Development Co.; A. Ludlow Clayden, Sun Oil Co.; Arthur W. Pope, Jr., Waukesha Motor Co.; J. Bennett Hill, Atlantic Refining Co.; Harry F. Huff, Atlantic Refining Co.; Edward P. Barnard, Standard Oil Co. (Ind.), and Claude S. Kegerreis, consulting engineer

# Vapor Lock Problems Increase as Fuel Line Temperatures Mount

Fuels Session

IF THE evidence presented at the Fuels Session can be taken as a criterion, the problem of vapor lock in modern automobiles is becoming more severe. Although much has been learned regarding the causes and design features affecting vapor lock, apparently little has been done to correct the trouble.

The discussion centered largely around a paper entitled "Fuel Line Temperatures in 1931 Motor Cars," by O. C. Bridgeman and H. S. White of the Bureau of Standards. Three other papers were presented at the session, C. S. Kegerreis, consulting engineer, Toledo, described a "Carburetor Design for the Fuel Research Detonation Engine"; Donald Brooks, Bureau of Standards, discussed "The Interpolation Method in Detonation Testing," and Dr. Bridgeman and Miss E. W. Aldrich presented a paper summarizing "Further Developments in Determining Gum in Gasoline." Discussion on the papers by Mr. Kegerreis and Mr. Brooks was deferred to the meeting of the Detonation Sub-Committee of the Society.

While Dr. Bridgeman in his paper on "Fuel Line Temperatures" had only limited data for 1931 passenger cars, this seemed to indicate that temperatures are running somewhat higher in 1931 models than in cars of the previous year. The paper, moreover, brought out the wide difference in fuel line temperatures of 1930 passenger cars. Representatives of oil companies emphasized these differences.

The case for the oil companies in the argument as to responsibility for vapor lock was presented by Dr. A. E. Becker, Standard Oil Co.; J. B. Hill, Atlantic Refining Co.; G. B. Oberfell, Philfuel Co.; A. L. Clayden, Sun Oil Co., and D. P. Barnard, Standard Oil Co. (Ind.). Their argument was that since the oil companies had been forced by public demand to provide more volatile fuels for starting, it was up to passenger car manufacturers to so design the fuel lines so as to prevent vapor lock. In other words, the oil companies felt that as long as variations in fuel line temperatures are as great as at present, it is a problem for the car designer.

Representing the passenger car companies were: W. S. James, research engineer, Studebaker Corp.; F. S. Marks, chief engineer, H. H. Franklin Mfg. Co.; B. B. Bachman, vice-president, the Autocar Co.; F. C. Mock, Bendix Research Corp., and Dr. H. C. Dickinson, Bureau of Standards.

The argument of car engineers centered around:

(1) Vapor lock problems as brought about by the use of fuel pumps, and

(2) Vapor locking tendency of cars in the field as a result of gasoline specification changes.

Regarding the first of these, fuel pumps, Mr. James stated that the vacuum tanks in past years distilled off the lighter ends. Dr. Dickinson claimed that of the 25,000,000 cars or so registered in this country virtually none had given vapor lock trouble except those equipped with fuel pumps.

A carburetor for use with a fuel-testing engine should preferably give a constant mixture ratio throughout the load range, but above all it should make it possible to reproduce the same operating conditions accurately, said C. S. Kegerreis in his paper. In commercial carburetors a metering accuracy of between 5 and 8 per cent is sufficient, but in a carburetor for a fuel-testing engine the metering should be between 2 and 3 per cent.

An ordinary conical valve will not permit of sufficiently fine adjustment of the fuel feed, as it will usually be open less than a full turn, and any clearance in the threads or inaccuracy of the needle or orifice will aggravate the conditions. Closer adjustment can be obtained by means of an air bleed, and this is used in a carburetor which was developed by the Anglo-American Oil Co. in England for use in detonation testing work.

C. S. Kegerreis described a carburetor designed for research work

From this carburetor, known as the Dobbs, a new design has been evolved for use with the American standard fuel test engine. The design permits of being made with either two float chambers for research work or with four float chambers for routine testing. In testing this equipment it was found that the engine was extremely sensitive to changes in angular position of the butterfly throttle. The throttle, therefore, was changed to the barrel type with worm and wheel operation, and thirteen complete turns of the worm knob are now required to move the throttle through its full range.

While Miss Aldrich effectively demonstrated the importance of gum in gasoline, the discussion once more emphasized the fact, as stated by Dr. A. E. Becker, Standard Oil Co., that a satisfactory method for determining the gum content of a gasoline by tests which would be reproducible from laboratory to laboratory, had not yet been developed. Dr. Bridgeman, co-author of the paper, stated that the copper-dish method was satisfactory from one point of view only: It would segregate the gasolines which absolutely would not do. However, it does not enable one to tell whether a gasoline, which fails to pass, is really unsatisfactory. Dr. Bridgeman disagreed with Dr. Becker in giving it as his belief that the first thing to be determined is significance of the test method and not reproducibility.

Engine Session

# Ratio of Oil Consumption to

## Miles per gallon of oil is greatest with oil having the highest viscosity at 210 deg.

by Athel F. Denham

JUST where the discussion at the Engine Session would have led if no halt had been called by the chairman is an interesting subject for speculation. All of the three papers presented at the session were of a character to provoke argument, and the discussion following the reading of the first two was lively and protracted. Unfortunately there was little time left for the presentation of the third paper.

First there was the argument regarding factors affecting the efficiency of cooling fans, which followed the presentation of the paper by A. D. Gardner (Automotive Fan and Bearing Co.) on "Reducing Horsepower and Noise of Automotive Cooling Fans." This paper dealt with a comprehensive series of tests on fan horsepower requirements, with changes in fan design, and also their effect on fan noise. Louis Schwitzer, Schwitzer-Cummins Co., Indianapolis, in a discussion received by letter, stated that these problems had been solved long ago, and that present troubles were largely up to the chassis designer. L. P. Saunders, Harrison Radiator Co., said that in his opinion the basic problem, as far as fan horsepower was concerned, was "static pressure." Where static pressure is high, fans just won't work; they will merely churn the air. Mr. Saunders said that a static pressure of one inch of water column is equivalent to a reduction in air speed of 4000 ft. p. m. He also gave a "general requirement" figure of one cubic foot of air displacement per B.t.u. per minute transferred to the jacket water.

A. D. Gardner presented a paper on "Reducing Power and Noise of Fans"

There is no analogy between automotive fans and airplane propellers, Mr. Saunders continued, since the latter are not affected by static pressures. Air flow, he stated, is caused by the pressure difference ahead and behind the fan.

In his paper, Mr. Gardner had shown a typical air flow chart of a fan which indicated a reversal of flow at the center near the hub. This, Mr. Saunders stated, was due to radial flow of air from the fan hub outwards, due to centrifugal action, and he added that it could be corrected, and fan horsepower requirements probably reduced, by the use of a curved disk at the rear center of the fan blades, as used by Daimler abroad.

Referring to an article on radiators by A. F. Denham in the June 13 issue of *Automotive Industries*, in which it was stated that a considerable increase in the top speed of a car had been obtained by merely disconnecting the fan, Mr. Saunders said this might be due to the elimination of "supercharging" effect on the fan, with high air flow, which supercharging effect materially increases the horsepower absorbed by a fan of the disk type.

About six square feet of radiator cooling surface is needed per horsepower at 20 m.p.h., according to Mr. Saunders. This speed, he said, is now the worst one for the average automobile, probably because of the recent decreases in frontal areas.

Some of the material in Mr. Gardner's paper, especially that relating to the effect of various factors on fan noise, was discussed in an article which appeared in *Automotive Industries* of May 23.

Oil Consumption as Affected by Engine Characteristics was the title of a paper prepared by H. C. Mougey of the General Motors Research Corporation. According to Mr. Mougey, the factors affecting the oil consumption, in the order of their importance, are:

1. Engine speed
2. Oil leaks
3. Design of the lubricating system and changes due to wear
4. Viscosity of the oil
5. Volatility of the oil
6. Pour test
7. Possible carbonization of oil-control rings
8. Length of time between oil changes.

# Mileage Greater at Higher Speed

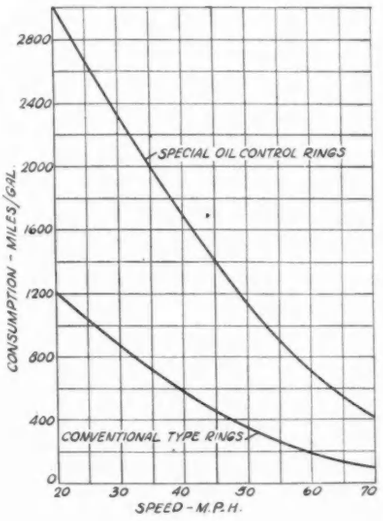



**Fig. 1—Effect of oil-control rings on consumption**

Results of tests on oil consumption were quoted in the paper, the tests having been made with two different oils having the same viscosity at 100 deg. but different viscosities at 210 deg. The tests were made with two six-cylinder cars of different makes, at 30, 40, 50 and 60 m.p.h. The miles per gallon of oil were greatest in all cases, with the oil having the highest viscosity at 210 deg., and it was shown that the oil consumption increases very rapidly with the speed. For instance, one of the cars ran only 170 miles per gallon on one oil and 190 miles on the other at 60 m.p.h., while at 30 m.p.h. it ran 3850 miles per gallon on the first oil and over 4000 miles per gallon on the second.

Engine speed affects oil consumption because (a) the viscosity of the oil decreases with increase in temperature incidental to high speed; (b) piston rings fail to scrape off oil at high speed; and (c) an increased amount of oil is thrown onto the cylinder walls at high speed, owing to the increased pressure of the oil pump, the greater effectiveness of the crankshaft as a centrifugal oil pump, and the greater tendency of the oil to leak past the connecting-rod bearings on account of the lower viscosity of the oil.

Oil leakage includes liquid leakage at stationary joints of the crankpan with the crankcase, lubrication fittings outside the crankcase, etc.; mist and vapor losses at breathers, crankcase ventilators, oil-filling openings, and other openings of the crankcase, and liquid losses at joints where rotating members penetrate the crankcase wall. All of these losses are greatly affected by speed, because vapor and fog are developed in greater quantities at high speed and high temperature, the viscosity of the oil is much lower, due to the high temperature at high speed, and liquid losses at all openings are greatly increased by increased pressure inside the crankcase. Most of this pressure difference is due to the vacuum outside the crankcase resulting from the movement of the engine through the air, which is similar to that behind a rapidly moving train or automobile.

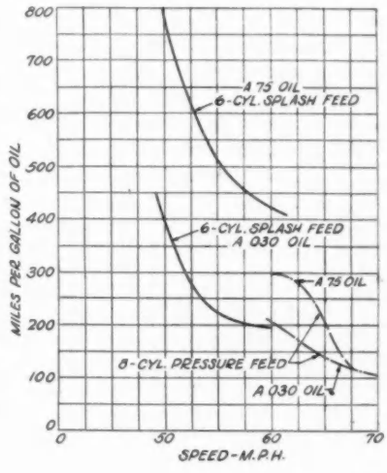
When a car has been driven on the road at high speeds and the under part of the engine is then examined, many oil drops and indications of oil leakage will be found, and the leakage is very much reduced when the engine is operated under similar conditions on the chassis dynamometer. At 60 m.p.h. the miles per gallon on the road often is only one-half to one-third as great as on the chassis dynamometer. The effect of speed on oil leakage can be plainly seen on concrete roads in the country; wherever the conditions are good for high speed there is much oil on the road.

Blow-by does not appreciably increase the pressure in the crankcase, unless breather or ventilating openings are obstructed. Records show that oil consumption is greater in cars with pressure lubrication than in those with splash lubrication, and that the consumption in both classes increases with wear after the first few thousand miles, during which period it may decrease due to the wearing of piston rings and other parts.

All lubricating systems are subject to a greater or less delay in the delivery of oil to bearings and cylinder walls on starting, particularly the pressure-feed systems. Many patents have been granted for means of delivering oil directly to the cylinder walls under pressure immediately on starting. Pulling out the choke, stepping on the starter, or other motions incidental to starting have been suggested as methods for automatically operating devices to provide this lubrication, but if the pump cannot build up pressure and deliver it through the regular system, these special devices fail. In some cases changes in the oil-pump

**Fig. 2—Effects of viscosity on consumption + +**

Oil A 030 has a viscosity of 265-340 at 100 deg.; 130-145 at 130 deg., and 47 at 210 deg.; oil A 75 has a viscosity of 760-1010 at 100 deg.; 300-380 at 130 deg., and 70-80 at 210 deg.



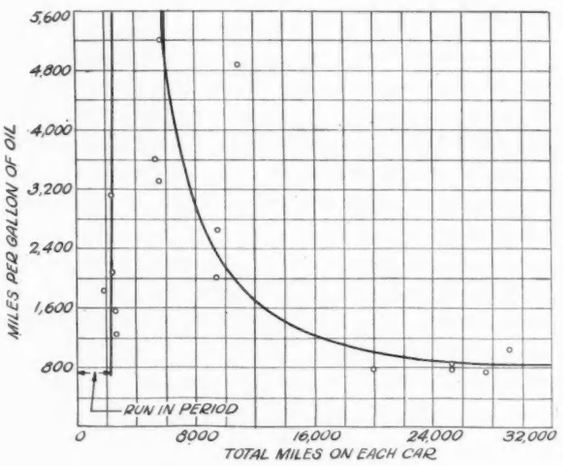



**Fig. 3—Effect of state of engine wear on consumption + + + + +**

(Data from 19 six-cylinder cars of the same model with splash-feed engine lubrication; speeds, 40-45 m.p.h. from 2000 miles on) +

inlet systems to shorten this initial period of insufficient lubrication involve means of by-passing the oil screen if it offers too much resistance to flow of the cold oil.

To help in getting oil to the cylinder wall at low speeds, spit holes are frequently drilled in the connecting-rod bearings. These holes act to increase the leakage past the connecting rods and to direct this oil toward the cylinder walls, but they are much more effective at high than at low speeds.

Some automobile companies try to control oil consumption by working on the registry of the lubricating grooves of the main bearings. By decreasing the length of this groove from 360 to 180 or even 90 deg., the amount of oil pumped to the connecting rods is decreased. Since this operates at all speeds, trouble is experienced from insufficient lubrication at low speeds, and the oil pressure is then increased to cure this, with resulting over-lubrication at high speeds.

Tests were carried out in the General Motors Laboratories to try to control oil consumption by controlling the oil pressure. It was soon found that there was a limit below which decrease in oil-pump pressure had little effect, because the crankshaft acts as a centrifugal oil pump in series with the regular oil pump, and at high speed it will develop quite high pressure if supplied with oil. Brooks and Sparrow have shown a pressure of 78 lb. p. sq. in. to be developed by the crankshaft independent of the oil pump at 4000 r.p.m.

There is a possibility that carbonization of oil-control rings, with blocking of the holes and oil slots and sticking of rings in their grooves, will decrease the effectiveness of the rings, but the subject of carbon formation in the ring grooves is poorly understood, and little definite can be said about it.

When a car is habitually driven at high speeds the owner should try to maintain the crankcase level at the "full" mark, instead of letting the oil get low on the assumption that in a short time the crankcase will be drained and the oil in it at that time thrown away. In most cases when the oil is a factor in the burning out of bearings, it is the absence of oil from the bearings rather than the properties of the oil which was used that was to blame. As regards the length of time between oil changes, Mr. Mougey merely pointed out that when a car is normally driven at low speeds and the consumption in operation therefore is low, frequent renewal of the crankcase supply has the effect of greatly increasing the oil consumption. With cars usually driven at high speeds the actual oil consumption is less affected by frequent drainings.

Mr. Mougey's paper in the main was a plea for the use of engine oils of lower viscosity which, he said, are desirable for use in winter because they facilitate starting, and can be used also in summer if certain changes in mechanical design are made.

In discussing this paper, Alex Taub, Chevrolet Motor Car Co., said high oil consumption stands between us and this ideal. His chief criticism, however, was directed at the recommendations of the oil companies, which are very much at variance, even when S.A.E. viscosity numbers are used, and he felt that car manufacturers might well institute a vigorous campaign of education regarding the proper oils for use in their cars.

Two rather widely used "recommendations" of service stations were particularly criticized by Mr. Taub. These were

1. The use of penetrating oils mixed in with lubricants for running-in periods.
2. The use of higher viscosity oils when oil consumption appears to be high.

Regarding the first of these Mr. Taub said: "In many cases the use of such penetrating oils serves to give an early run-in 'feel.' Actually the bores may be run in, but the bearings are still too tight for high-speed work. The run-in is unabalanced, and with a large production, this may be productive of trouble."

With regard to the second, Mr. Taub observed: "The difficulty lies in the state of mind of the motorist between periods of oil change. If he is aware that his oil is apt to get dangerously low on short trips, he becomes dissatisfied because he is left on edge and will immediately accept the ill-considered advice from oil station attendants and use heavier lubricants unsuited to the powerplant he is operating. He may thus eliminate a continuous petty worry, but will find that he has substituted therefor a major collective worry when he discovers premature piston-pin and bore wear due to under-oiling at starting, and loss of speed and sticking of valves under hard driving."

It was Mr. Taub's contention that the major part of oil consumption frequently is due to oil-leaks rather than to actual internal consumption.

Only little argument was offered that oil viscosity ratings should be increased in order to assure safe viscosities at the high temperatures encountered in bearings of automobile engines today. Mr. Taub and Mr. Mougey both felt that oil coolers were proving a major help. Mr. Taub also referred to the development of new bearing materials as probably serving to increase the safe temperature at which bearings could be operated. *(Turn to page 1000, please)*

# JUST AMONG OURSELVES

## At the Summer Meeting

### A Perfect Setting And a Fine Show

WEATHER perfect, technical papers good, discussion lively, golf courses in fine condition, hotel and surroundings delightful, attendance fair—that's a brief summary of this best all-'round summer meeting the society has ever held.

### Women Non-Committal On Speedy Driving

WALTER C. KEYS, chairman of the passenger car session, on Tuesday evening, invited the visiting ladies present to participate in discussion of J. E. Hale's paper on driving high-speed cars.

First time such invitation had been extended, he said. Probably the ladies appreciated it—but they didn't take advantage of it.

### Wabbliness of Members Measured by Instrument

THE wabblemeter—an instrument which measures the inability of a human being to stand steady in an upright position—is well known to all members of the society and its friends as a result of its participation in the summer meeting.

The research committee and the council knew quite a little about the wabblemeter many months ago—at least the research committee did and the council thought it did—but now lots of other folks have seen it and watched it work.

G. C. Brown had a working instrument at the meeting and was kept busy testing the stability of golf—and hike-tired members for over four hours in the lobby one evening.

He just couldn't break away once he had consented to demonstrate the instrument to a few curious friends. The number of those interested just kept increasing.

### Lubrications Are Up For Some Investigation

THE research committee has approved appointment of a sub-committee whose purpose it shall be "to develop tests to evaluate the properties of extreme pressure lubricants, and to develop tests to determine what are the lubrication requirements of gears and bearings, with the idea of correlating the tests on the oils with the requirements of the gears and bearings."

The committee has been trying to figure out how it could help on this now long-standing problem for some time and this decision has been taken as a result of a program submitted by a special sub-committee which was headed by Harry Clifford Mougey.

### Many Interests Are Represented

THIS purpose will be carried out by a new committee on which will be representatives of axle makers, truck builders, car builders, and bearing manufacturers, as well as of oil refiners and vehicle operators.

The preliminary program will consist first of finding out exactly what work already has been done along this line and correlating the result. Then, it is proposed to "get lubricant of the type that is supposed properly to handle hypoid gears and have it tested by different groups to see if it passes their tests. It will be found that there will be a disagreement. The reason for the disagreement and the way to take care of it will be the first real problem."

The results of this work will undoubtedly be looked for with great interest by a widespread group of engineers as the problem, so clearly outlined by A. J. Scaife in *Automotive Industries* of June 13, has become more and more perplexing as time went on.

### Congratulations On Daily S.A.E.

EDWARD G. BUDD MFG. CO. was responsible for the *Daily S.A.E.* this year and we heard several people say they thought a new high mark had been set. Certainly it was a mighty lively and entertaining publication with which to be greeted at breakfast each morning. Congratulations, Mr. Coward and Mr. Bettle, to you and your coworkers!

### President Entertains Aero Men and Officials

PRIOR to the aircraft session on Wednesday evening, President Bendix entertained at dinner in his suite Hon. D. S. Ingalls, Assistant Secretary of the Navy for Aviation, who was the speaker of the evening; Clarence D. Young, Assistant Secretary of Commerce for Aviation; Dr. G. W. Lewis, National Advisory Council for Aeronautics, who was to be chairman of the meeting; Giuseppe M. Bellanca and several society members who had special aviation interests.

—N.G.S.

Aircraft Engines

# Excessive Heat in Cylinder-Head Causes Most of the Valve Troubles

## Copper forged into the stems is the latest development in poppet valves for aircraft engines + +

by Herbert Chase

Roland Chilton said that an increase in the length of pistons would be beneficial

AIR-COOLED Cylinder-Head Design was the title of a paper which Roland Chilton, consulting engineer, Wright Aeronautical Corp., presented at the Aircraft Engine Session. Mr. Chilton complained that aircraft engines often are operated on fuel that has a lower knock value than automobile Esso. Consequently engines must be rated at the power they will safely develop on the poorest fuel with which they are likely to be supplied.

For a fuel of given iso-octane value the limiting output of the engine depends upon the combustion chamber temperature. Excessive cylinder-head temperatures and the accompanying detonation are the cause of most of the cylinder head and valve troubles in modern engines. There is a direct relation between the b.m.e.p. and temperature; up to a certain critical point they increase together, but beyond that point detonation occurs, the temperature increases suddenly and the power falls off. One object of head cooling is to make this critical point correspond to the highest output. A thermocouple arranged to measure cylinder head temperature is a much better index of engine operating conditions than the usual oil temperature measurement.

A. T. Colwell presented a paper on recent Developments in Poppet Valves

The ideal condition for air-cooling is represented by a streamlined body having longitudinal fins and a truly axial air flow, which supposes absence of interference from adjacent bodies. These conditions do not exist in air-cooled cylinder heads. In unbaffled engines most of the air stream misses the leeward part of the finning, and the entire flow is much disturbed. Behind a normal tractor propeller the lines of air flow diverge by 45 deg. or more from the axis of the free stream. A ring cowl, brought as close to the propeller as possible, helps to redirect some of this diverging flow toward parallelism with the cooling fins.

In the discussion of Mr. Chilton's paper it was stated that the use of fuels with high octane numbers would permit of higher compression or supercharging pressures with corresponding increase in power output and still give a desirable margin of safety. Since the exhaust valve is one of the hottest spots, special deflectors sometimes are used to assist in directing air against exhaust port fins and thus help to keep these valves cool. Valve cooling is facilitated also by exposing as little of the stem as possible to the exhaust gas stream. Sometimes it is better also to use more metal around the exhaust valves, to assist in conducting heat to adjacent parts, than to attempt to force air through narrow spaces between fins that are too close together.

In response to questions regarding the optimum number of rings and the best length of piston, Mr.

### TABLE I

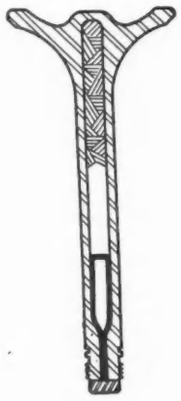
### Physical Properties of Sodium and of Eutectic Mixture of Potassium and Lithium Nitrates

| | Sodium | Eutectic |
|---|---|---|
| Melting Point, deg. Fahr. | 207.5 | 265.0 |
| Boiling Point, deg. Fahr.* | 1,616 | ... |
| Surface Tension at Fusion Temperature, dynes per cm. | 258 | 100† |
| Heat Equivalent of Fusion, cal. per gm. | 31.7 | 55† |
| Specific Gravity | 0.97 | 2.2 |

* Potassium nitrate decomposes at 750 deg. Fahr.
† Approximate.

Chilton indicated that an increase in both over conventional practice probably will prove beneficial. Higher compression tends, he said, to put more heat into useful work and less into the piston and exhaust gases, so that exhaust valves actually run cooler if the fuel is such as to avoid detonation. D. P. Barnard pointed out that poor distribution and not detonation has proved to be the cause of sticking rings in some engines.

A. T. Colwell, chief engineer, Thompson Products, Inc., in his paper on Recent Developments in Poppet Valves, said that sodium is taking the place of a eutectic mixture of potassium and lithium nitrates as a coolant for valves with hollow stems partly filled with a heat-transfer medium. The properties of the two media are compared in Table I. The vapor pressure of sodium is far below that of the salts, which allows the valve to be heat-treated after being filled with sodium, while with salts the high pressure developed prevents this. Sodium is more dangerous to handle than salts, as it reacts violently with water, and if pressure is applied the reaction takes the form of an explosion. The sodium must be kept under kerosene until ready for use. Before filling, valves



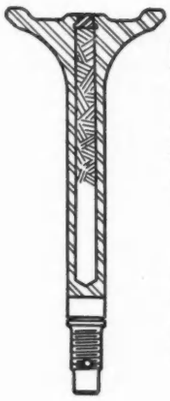


Fig. 1—(Left) Valve sealed by swaging, with thimble to keep spring cool + +

Fig. 2—(Right) Hollow stem closed by plug in head + +

are preheated to 700 deg. Fahr. to drive out all moisture and also to create a partial vacuum after the valve is closed and has become cool. Solid sodium is placed in the stem, and the valve is immediately sealed.

Considerable progress has been made in the process of sodium filling. In some cases it is desirable to block the sodium well up the stem to prevent heat from reaching the spring. The method of doing this with a capsule is illustrated in Fig. 1. A swaging operation seals the sodium, and the welded tip doubly seals.

Fig. 2 shows a method of inserting a cold plug in the head and then pressing the valve nubbin in around it. This method seals the sodium effectively, but any sealing operation in the head or hot portion of the valve is not considered to be the best practice. A plug is sometimes screwed and welded into the head of the valve. An objection to this method is that the welding heat expands the entrapped air, causing blow-holes in the weld.

To seal the sodium in without swaging, a plug is pressed against a shoulder in the stem; behind this

## TABLE 2

### Thermal Conductivities of Valve Materials

| | B.T.U. Per Hour Per Sq. Ft. Per Inch Per Deg. F. |
|---|---|
| No. 1 Silcrome | 142 |
| No. 2 Silcrome | 174 |
| C N S | 128 |
| Cobalt chrome steel | 183 |
| No. 1025 steel | 390 |
| Copper | 2640 |
| Sodium (liquid) | 638 |
| Mercury | 55 |
| Aluminum | 1450-2900 |

two copper gaskets are placed and a threaded plug is forced against them with considerable pressure.

Copper-cooled valves are the latest development. The copper is forged into the stem and the type of steel used determines whether or not there is a bond between the steel and the copper. In cases where there is no bond, the fit is so tight that good heat conductivity is obtained. Conductivities of several valve materials are given in Table 2. Running tests show that copper-cooled valves run at considerably lower temperatures than solid-steel valves, depending upon the proportion of copper used in the stem and head. Copper-cooled valves also are said to be quieter in operation, as they do not ring when struck.

Manufacturers of engines for buses and trucks have been annoyed recently by pickup or warts on valve seats. Small file-hard spots appear on the seat of the valve and wear the block seat down very rapidly. The exact cause of the phenomenon is not known, but the explanation is supposed to be that the outer layer of the valve seat reaches a very high temperature, at which the metal of the valve has an affinity for the metal of the block. The picking up also unseats the valve, causing valve burning and drawing of the block. There are several remedies for this condition. In many cases the use of ethyl gasoline will stop the trouble, probably because the lead deposited by the combustion of this fuel forms an insulating layer between valve and block. Better cooling of the block helps greatly. The use of chromium nickel or molybdenum alloy in the block helps, and 30-deg. seats reduce the trouble as compared with 45-deg. seats, probably because the more rapid opening of the valves with the former reduces the heating. The one sure cure is the use of a seat insert in the block, such as Elkonite, fine-grained molybdenum iron, high-speed steel, aluminum bronze or stellite puddled on steel. All except the Elkonite must be held in the block by peening the iron over the edge of the insert, on account of differences in expansion. Top lubrication tends to prevent pickup.

In the discussion it was brought out that the valves used in many aircraft engines run cooler and give less trouble from pickup than do those in truck and bus engines, especially when aluminum-bronze seats in aluminum heads are employed. Pickup occurs, according to some who discussed this point, only when a ferrous metal is used for the seat. Bronze seats would work well in cast-iron heads were it not for their greater heat expansion than that of the head metal.

Motor Trucks
Motorcoaches

# Standard Method for Rating Trucks

by
Norman G.
Shidle

**Although with a wide divergence of thought, the need for a uniform system was recognized by the majority present and the movement was launched with enthusiasm + + +**

THE Society of Automotive Engineers is going to appoint a committee to try to work out a scientific and generally acceptable standard method of rating motor truck and motor bus capacities.

When this committee goes to work it will represent the first concrete, *cooperative* effort on the part of commercial vehicle makers and users to find some definite solution to a problem which has been a daily vexation in the truck business for many years.

The personnel of the committee has not yet been determined and it will be many, many months, perhaps years after the committee actually begins to function, before anything like generally agreed upon results can be expected. But in the meantime there is real inspiration to be gathered from the knowledge that this vital problem finally is going to be tackled specifically, scientifically and cooperatively and that the full facilities and the eminent personnel of this great automotive engineering organization will be at the disposal of the representative group finally charged with the seeking of a satisfactory formula.

Decision to take this definite step came during the opening days of the summer meeting as a result of a recommendation and resolution sent to the Council of the Society by the opening session of the meeting, Sunday, June 14. At that session Martin L. Pulcher, president, Federal Motor Truck Co., and a member of the N.A.C.C. motor truck committee, and L. R. Buckendale, executive engineer, Timken-Detroit Axle Co., presented papers making specific suggestions as to possible standard methods of motor truck rating.

F. K. Glynn

**Presented the following resolution which was adopted—"It is the recommendation of this meeting that the Motorcoach and Motortruck Activity Committee, together with the Transportation and Maintenance Activity Committee, form a joint committee to study truck rating with a view to bringing forth some generally acceptable method of rating trucks" + +**

In the discussion which followed concerning the merits of weaknesses of the particular formulae offered by the speakers, the desirability or practicality of any standard method of rating whatever began to be debated outspokenly, and sometimes acridly. While subsequent events proved a good majority of the representative engineers and fleet owners present to favor some standard rating method and to believe in the possibility of its development, there were those who clearly were skeptical about the chances for ever building a useful formula and others who quite evidently were not much in favor of having one even if it could be built.

Pierre Schon, General Motors Truck Co., for example, expressed the opinion that: "Insofar as devising a standard method (of rating) which may be used as a guide for the different manufacturers in rating their vehicles is concerned, it is very doubtful if the society or any other organization would be willing or even capable of mastering such a task." Following an exposition of the merits of the gross weight rating as opposed to the tonnage rating idea, he stated, moreover, that: "I can definitely say that we have no problems to solve insofar as the rating of truck chassis is concerned."

Merrill C. Horine, sales promotion manager, Mack Trucks, Inc., indicated a belief that a practical rating standard cannot be developed, saying, among other things that: "So long as research and engineering persist in developing better ways of doing things, just so long will formulae of the type proposed be misleading and ineffective.

"Load capacity," he continued, "depends upon tire capacity, spring capacity, strength of load sustaining parts, bearing sizes and loadings, performance ability, chassis weight, body equipment and weight, nature of load, character of roads, speed grades and load distribution.

"Can any yardstick," he asked, "any rule of thumb correctly reflect all of these factors? Despite the A.L.A.M.. horsepower formula, the average purchaser of a gasoline engine must depend upon the trustworthiness of the manufacturers' ratings to guide him in the selection of the type which will do his work. Despite knock-tests, end points and gravity tests, we all

# to be Determined by Special Committee

buy gasoline by brands and manufacturers' gradings. How then shall we rate the tremendously more complicated capacity of a motor truck? In doing so, what shall we rate?"

But for every important engineer at the meeting who thought the search for a standard method of rating futile or undesirable, four or five others rose to express strong belief in the need for a standard rating method, confidence in the possibility of eventually developing such a standard and hope that definite action toward that end might be taken by the society.

On this latter side of the debate were found such design engineers as B. B. Bachman of Autocar, C. A. Peirce of Diamond T, A. J. Scaife of White, the society's presidential nominee for 1932, W. S. James, Studebaker, and A. G. Herreshoff of Dodge Bros. And ranged alongside them without dissenting voices were the representatives of the big fleet operators who included such men as T. C. Smith, American Telephone and Telegraph Co.; F. K. Glynn of A. T. & T.; Adrian Hughes, Jr., superintendent, United Railways of Baltimore; J. M. Orr, Equitable Auto Co. of Pittsburgh; J. F. Winchester, Standard Oil Co. of N. J.; P. P. Pierce, Vacuum Oil Co., and others.

Col. Herbert W. Alden, chairman of the board, Timken-Detroit Axle Co. and a past president of the society, presided at the session and indicated his belief in the need for better truck rating methods.

Even this latter group, of course, saw plenty of obstacles in the way of developing of a satisfactory standard rating formula and were far from being in any agreement as to the weaknesses or strengths of the formula suggested by the speakers of the evening, Messrs. Buckendale and Pulcher. Nor was there any real unity of thought about the factors and relationships between factors which should be included in a standard rating formula. But, in general, this latter group of engineers definitely favored going into the matter further and trying to do the job, while the fleet owners were vehement about the necessity of doing it.

Col. Herbert W. Alden

Chairman of the Board, Timken-Detroit Axle Co. and past president of the Society, presided at the session and indicated his belief in the need for better truck rating methods + + + + + +

Martin L. Pulcher

Made an important point when he said that "the rating problem will be solved only when it is removed from prejudices, departmental influence and considered strictly from the standpoint of performance on the open highways"

Specific statements indicated this general agreement clearly in most instances. Mr. Bachman and Mr. Scaife, for example, by the very detailed and specific suggestions which they made for modification or revision of the Buckendale formula showed clearly their belief in the desirability of thinking and development along these lines.

Mr. Peirce, Diamond T's chief engineering executive, said definitely: "I think that a formula of the kind developed by Mr. Buckendale can be made to work because I have been using it for several years, and in each case where a truck has been put into service under the conditions as outlined, it has been a satisfactory job." He emphasized, too, that "we cannot expect a formula to go out and perform in all the exceptional cases. "Much undue stress," he continued, "has been laid on the exceptional sand conditions and the dumpers, and business which Mr. Pulcher has said that we are not particularly eager to take except under certain conditions where we know the conditions and can prepare a vehicle for that work. . . . Almost everything tonight has seemed to make this problem a lot more complicated. I think it can be made simple by a study which I would suggest be made, perhaps by a committee appointed to further carry out this idea which I think has been so well presented by Mr. Buckendale and Mr. Pulcher."

Mr. Herreshoff said: "I believe the proper body to establish such ratings is the S.A.E.," while W. S. James, research engineer, Studebaker Corp., voiced the belief that "the rating worked out by the proposed

S.A.E. committee would be arbitrary, but it would at least furnish a common basis to start from as well as finish the final purchase."

Even more definite were the truck and bus operators about the need for some sort of standard rating. T. C. Smith, A.T.&T., expressed a general sentiment from this group when he said: "I am in hearty agreement with anything that can be done to clarify this matter of truck ratings."

Particularly pungent was the comment of J. F. Winchester, who said: "One of the difficulties with the motor truck industry is that questions of this kind have not been decided at an earlier date. We have before us really two propositions; we have the proposition of rating and we have the proposition of Mr. Schon that the entire matter be dropped. I, for one, believe it would be a great mistake to drop it.

"I do feel that this problem can be tackled and carried out by a joint committee such as has been proposed.

"The type of argument heard here tonight is exactly the confusing type of argument that I hear week in and week out from salesmen who visit me. How one can buy trucks on those arguments really is beyond me."

And Mr. Hughes backed up this same view with the statement that "As an operator of trucks and buses I would like to say that I think this resolution is very, very important."

The resolution which finally was adopted by the meeting as a recommendation to the Council of the Society, was presented by F. K. Glynn, A.T.&T., a vice-president of the society and himself a member of the Council. It read:

"It is the recommendation of this meeting that the Motorcoach and Motortruck Activity Committee, together with the Transportation and Maintenance Activity Committee, form a joint committee to study truck rating with a view to bringing forth some generally acceptable method of rating trucks."

The resolution was approved by the Council on the following day and the personnel of the committee will be made up in the near future.

Detailed comment on the specific formula suggestions made by Mr. Buckendale and Mr. Pulcher ranged over a rather wide area, but frequently centered around the desirability of injecting speed as a factor in the Buckendale formula in one way or another. The Buckendale formula, it will be recalled by readers of last week's *Automotive Industries*, is:

$$\text{Gross Vehicle Weight} = \frac{T \times R \times E}{W \times (G + F)}$$

when T is engine torque in lb.-in.; R is total gear reduction on; E is overall mechanical efficiency; W is radius of tire under load; G is gradient, expressed as amount of rise in ft. per ft. traveled, and F is rolling resistance, expressed as lb. of resistance per lb. of load.

Mr. Pulcher, it will be recalled, suggested the relation of carrying capacity to chassis weight as a basis for a standard rating formula, saying that "consideration should be given to the development of a method or formula which would make the gross allowable weight or carrying capacity of a truck the product of the weight of the chassis, fully equipped, multiplied by a constant or fixed number." The tractive capacity of the vehicle might be determined by a somewhat similar formula, he added. (Full details of both Pulcher and Buckendale papers appeared in *Automotive Industries*, June 20.)

Commenting specifically on these formulae, Mr. Scaife said in part:

"I agree with Mr. Pulcher that truck ratings should be considered strictly from the standpoint of performance on the open highway. He suggests a formula for so doing, in which consideration is given to weight and ability.

"These two requirements are discussed in Mr. Buckendale's paper with the suggestion that 'trucks be rated by the gross vehicle weight that can be hauled up standard grades.' In both papers some consideration is given to tire size and gear ratio, and while we cannot change the horsepower we can change the torque pounds feet, so that it is possible to propel a vehicle up a fixed grade by lowering the gear ratio or using smaller base tires. This then brings in another factor, that of speed. To illustrate: An engine with 200 lb. ft. torque and a vehicle with a gross load of 8000 lb. will negotiate a 6.6 per cent grade at 20 m.p.h., with an axle ratio of 6 to 1 using 30 x 5 tires on a 30 lb. road. If the speed were not taken into account, it would be possible to take 16,000 lb. or twice the gross, up a 6.6 per cent grade with a 200 pounds feet engine by changing the gear ratio from 6 to 1 to 12 to 1. This would give the same peformance from an ability standpoint, but would only run 10 m.p.h. instead of 20.

"Pounds feet torque is suggested rather than cu. in. displacement as it is necessary to take compression ratio into the calculation due to the low, medium and high compression engine giving different results with the same cu. in. displacement.

"I suggest that we consider a formula having the following as a basis:

"1. Gross load in relation to chassis weight.

"2. Ability as expressed in pounds feet.

"3. Fixed speed as a constant in m.p.h."

Mr. Bachman also pointed out the need for injecting a speed factor into the Buckendale formula and suggested that "the engine speed, using the gear ratio and wheel size adopted for obtaining the gross vehicle weight, be kept within definite limits." These limits, he suggested, should be from 50 to 75 r.p.m. for each m.p.h. of vehicle speed; the lower figure to apply to the lighter classes of service and the higher to heavy duty engines.

Mr. Bachman made three additional suggestions as follows:

"1. That the gross vehicle weight be determined by using a gradient factor of 3 per cent in direct gear, which I believe represents a sound basis for present practice and a reasonable future.

"2. That this factor be used for all types of hauling including tractors and heavy duty vehicles for the reason that it considers the problem from the standpoint of ability only.

"3. That for dump service and tractor the gears, bearings and structural load carrying portions of the chassis be compared on a basis of continuous operation in next to top gear."

Mr. Herreshoff proposed for discussion that a system of rating be used in which tire size is the limiting factor of the weight to be carried unless the manufacturer chose to rate his vehicle less than the amount allowed by the tire sizes. He proposed also that "the vehicle shall have three or four different ability ratings, these ratings, of course, to take in speed."

Mr. Horine also mentioned tires as a basis for rating, saying: "We have very little to complain of in the ratings which tire manufacturers have given us."

Passenger Car Bodies

# Reduced Chassis Flexibility Obviates Excessive Body Weight

THAT body troubles, such as squeaks and rattles, and breakage of frame brackets, are caused as much by high-frequency vibration as by distortion of the assembled car, was an opinion that was freely voiced at the Body Session held on Tuesday morning. Three papers were presented at this session: one on Instrumentation as a Means for Coordinating Chassis and Body Design, by A. F. Denham, field editor of *Automotive Industries*, which was printed in abstract in our last week's issue; one on Chassis Design Data Which Body Designers Need, by R. F. Anderson of the Murray Corp. of America, and the third on Comfort and Interior Appointments, by H. A. Brunn, president, Brunn & Co., Inc.

R. F. Anderson told what body designers want in a chassis + +

Mr. Anderson said that before proceeding with the scale and blackboard drawings the body designer wants a preliminary outline of the chassis, showing all available tolerances for wheelbase, tread, frame and cross-member heights, frame width, tire diameter and clearances, and the locations of the dash, steering wheel, radiator core and gasoline-tank filler.

He pointed out that if the rear seat is located ahead of the rear axle it is possible to assure comfort with less overall height than if it is above the axle, in which case the axle housing and frame members must project up high under the seat cushion. The chassis frame should be made wide enough to obviate excessive overhang of the body, and to provide space for a recessed floor that will give adequate foot room for rear-seat passengers in a close-coupled body having low roof lines. The cross-members should be so located as not to interfere unnecessarily with recessing of the floor.

The body engineer is particularly concerned with some chassis details that affect the design of the body, including frame rigidity, anchor-bolt locations, battery location, space available for tire tools and the design of spare-tire supports. Chassis-frame rigidity is essential to a quiet body and to the free operation of the doors when the car is parked on uneven ground. A frame that twists ½ in. in 90 in. of length causes a 7/16 in. vertical motion at the lock side of the front and rear doors of a sedan when the center pillar is the lock pillar for both doors and the doors open enough to disengage the dovetails. The body designer wants chassis flexibility reduced to the minimum, in order to avoid excessive body weight, cost and service expense. A frame which deflects mainly ahead of the cowl and back of the rear axle would be best for the body.

As regards anchor bolts, the body engineer wants one near the base of each pillar at door openings, and additional ones in the door opening if the door is extra wide. The bearing area should be sufficient to assure rigidity in the relation of the body sills to the chassis frame. Access to the battery and to the tire tools should not require the removal of a cushion.

T. J. Litle, consulting engineer, in discussing Mr. Anderson's paper said that body bolts should be located not only at points providing the best protection against relative distortion, but that they should also be located at the nodal points of vibration waves in the frame, where vibration is a minimum.

Maurice Olley, Cadillac Motor Car Co., felt that high-frequency vibration was the major cause of body trouble, and not distortion. Whereas Mr. Litle suggested building frame and body integrally, Mr. Olley suggested the study of the vertebrate type of car in which the body is a separate entity.

P. J. Kent, electrical engineer, Chrysler Corp., said more fundamental information was needed regarding the causes of deflections, whether these are of a periodic or distortion character.

It was the opinion of Fred Duesenberg, vice-president, Duesenberg, Inc., that deflection troubles should be stopped where they start—at the running gear—and he recommended the use of lighter unsprung weight and possibly independent springing. Mr. Denham agreed with Mr. Duesenberg but pointed out that the double-acting hydraulic shock absorbers commonly used, virtually provide under sharp wheel deflections, an almost solid connection between running gear and frame. To Mr. Anderson's request that chassis flexibility be kept ahead of the cowl, Mr. Denham objected that deflections start largely at the front end of the chassis and if flexibility were permitted ahead of the cowl, the deflection would be built up by the time it reached the cowl.

Photo by Colgrove Studio

H. A. Brunn spoke on interior appointments and comfort in passenger car bodies + +

H. T. Woolson, chief engineer, Chrysler Corp., stated that the evident answer would have to be a compromise between what the body engineer wanted in a chassis and what the chassis engineer felt he ought to have aside from body considerations. W. E. England, Hou-

*(Turn to page 1010, please)*

# Hails Rear-Engine Streamlined Car and Increased Riding Comfort

Passenger Cars

**Air resistance of full streamline is 80 per cent less than that of conventional automobile of same capacity. Hale urges factories to educate owners in high-speed driving**

WHAT will likely be remembered as the high spot of the summer meeting was the session on Tuesday evening devoted to passenger cars and featuring the paper by Walter T. Fishleigh, formerly connected with the engineering department of the Ford Motor Co., on "The Tear-Drop Car," and another by James E. Hale, of the Firestone Tire & Rubber Co., on "Driving High-Speed Cars." Both papers excited keen interest and resulted in a lively discussion before one of the largest audiences of the meeting.

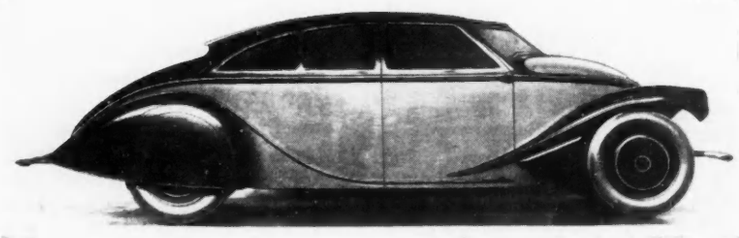
Mr. Fishleigh showed by a considerable number of slides the gradual development of automobile body forms from horse carriage forms. Among the bodies shown were those of a Hudson sedan of 1913 and a typical 1931 sedan, and the author called attention to the surprising similarity in outline, arrangement, and general lack of adaptability to high-speed travel. This seemed to point to the conclusion that practically no progress in body forms had been made during the past 18 years. A consideration of the above led the author some years ago to undertake a synthetic development of a fast automobile. The start was made from "scratch," as it were, and all of the features of the car were designed without regard to precedent, style and fashion. Referring to the advantages of streamline forms for automobiles, Mr. Fishleigh said:

"Today not only engineers, but the public, know that for high-speed travel through the air there are remarkable advantages, from the standpoint of air resistance, and therefore from the standpoint of power economy and speed, in shapes like the body of a trout or a bird. * * * Today, moreover, not only engineers, but the public, are familiar with and accustomed to, and like, the beauty of symmetry of full-streamlined bodies like the airplane and the dirigible, which aerodynamically spell speed, economy and comfort in automotive transportation. * * * But few people, and indeed few engineers, realize that at 30 to 60 m.p.h. a properly-shaped body will travel through air with one-third the resistance of an improperly shaped body of the same volume."

James E. Hale of the Firestone Tire & Rubber Co.

Mr. Fishleigh said that a modern automobile, with its many exterior air-disturbing appurtenances such as fenders, lamps, hardware, bumpers, axles, wheels and extra tires, offers about five times as much air resistance or drag at any speed as a full-streamlined airplane body of the same passenger-carrying volume. With these observations as a background the design of the tear-drop car was started upon. The number of passengers to be accommodated, and the desirable dimensions between seats, steering wheel and roof, etc., were determined at the outset, and the dimensions then laid off; around this was thrown a full streamline enclosure, and the resulting structure was then studied with reference to adaptability to doors, axles, wheels and engines. This led to the design illustrated. In working out this design it was discovered that in addition to its ability to travel fast through the air it offered many other advantages.

Models of one-quarter actual size were built of a standard closed car of latest design and the new "tear-drop" car, complete and exact in every detail, and finished in attractive colored combinations. They were displayed and their advantages were explained to 38 people, including chassis engineers, body designers, airplane experts, salesmen, general executives and the ordinary automobile using public. As a result all except four expressed approval, ranging from simple statements that they "thought such a design would be successful," to enthusiastic statements that "the design is absolutely right and the public would fall for it immediately." Of the dissenting four, two thought the design too radical to take at one step, one was non-commital but shook his head, and one remarked that "if you drove that



The Fishleigh body was built around the required inside arrangements + + + + + + + + +

# Because of Economy in Power

## by Herbert Chase

thing down Woodward Avenue, people would run for fright." It happened that one of the dissenters was the "boss" of the organization, which may explain why production models never appeared.

Considerable enthusiasm was expressed both by those who took part in the discussion and by the many members who congratulated the author following the meeting. The latter remained in session for a full hour after the time set for adjournment.

A. Ludlow Clayden, Sun Oil Co., spoke especially of the important advantage of better forward vision that results from a design such as that Mr. Fishleigh advocated, and David Beecroft, Bendix Aviation Corp., stressed the need for breaking away from tradition if advancement is to be made in car design.

Harry L. Horning, president, Waukesha Motor Co., spoke of the need for increased stability at high speed and of the advantage gained from reduced air resistance, especially in respect to increased fuel economy.

R. C. Hoffman, consulting engineer, made it clear that good streamlining will tend to prevent the eddies that carry insects into the car body when driving at high speeds and mentioned the need for considering factors that affect stability on the road. He showed also that increased headroom is possible in a car having the engine in the rear without increase in overall height, as compared to conventional cars.

Austin M. Wolf, consulting engineer, predicted that four-wheel drive on future cars will be found desirable and in the future will be considered of as much importance as four-wheel brakes are today. He indicated that a unit powerplant such as may be used in a rear-engined car is ideal from some standpoints, but is likely to be less accessible.

Mr. Hale's paper voiced the belief that, since the automobile manufacturer has put into the hands of the public cars that are capable of much higher speeds than heretofore have been common, something should be done to educate those who will drive these cars in ways of handling them safely at high speed, especially in emergencies.

In efforts to collect information on the subject, Mr. Hale found that even those with considerable experience in high-speed driving could not tell him what should be done in many emergencies that are likely to arise. In consequence, he had prepared a number of questions which he propounded in the paper, and he asked that members who had gained experience or knew the correct answers to advise him so that a set of rules could be prepared for distribution.

Walter T. Fishleigh spoke on "The Tear-Drop Car" + + +

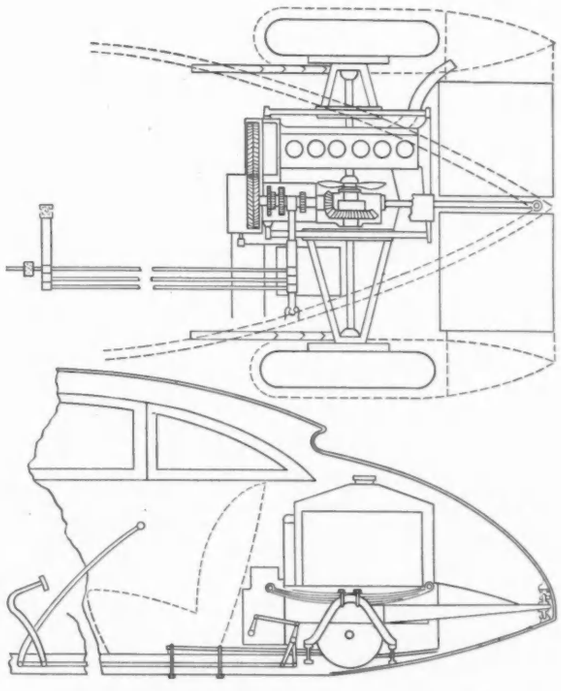
In the discussion, Dr. H. C. Dickinson, Bureau of Standards, pointed out that present steering gears appear to have been designed for ease in parking rather than for best steering at high speed and that improvements in this regard are needed, a "faster" gear (with less reduction) being desirable for high speed.

Braking, he said, is probably most effective when the brakes are applied as hard as they can be without producing a skid, but it is difficult for the user to know just when the right pressure for the fastest stop has been applied.

Burton J. Lemon, U. S. Rubber Co., stated that experiments made by the company have shown that there is no great difficulty in controlling a car when a front tire blows out suddenly at speeds of 65 to 70 m.p.h., since the tire, because of centrifugal force, does not go flat until the speed has been reduced greatly. Blowouts of the rear shoes are likely to prove more dangerous because of the side-sway that results.

In this connection Mr. Beecroft said that brakes should not be applied when a rear tire blows with the car traveling at high speed. He stated also that driving speeds are certain to increase in the future and referred to statistics that indicate that 80 per cent of today's

*(Turn to page 1010, please)*



In the Fishleigh design, arrangements were made for a rear-end engine location + +

Chassis Session

# Instrumentation Applied to of Rider Fatigue

## In a number of tests front seat passengers showed greater fatigue than those in the rear seats

IT was rather unfortunate that outdoor events encroached upon the time of the Chassis Session of the Society of Automotive Engineers, White Sulphur Springs, as two of the three papers presented, treating with the same subject—riding qualities—attacked the problem from two diametrically opposed viewpoints. Further public discussion regarding the merits of the two different methods of study certainly would have been justified.

As it was, the session dealt almost entirely with riding qualities, the three papers presented all dealing with this major topic. Roy W. Brown, Firestone Tire & Rubber Co., presented his paper on "The Tire Factor in Automobile Riding Quality," Dr. F. A. Moss presented some further data on "Road Tests With the New Wabblemeter," and Professor H. M. Jacklin of Purdue University read a paper prepared in collaboration with Dr. Ammon Swope, also of Purdue.

Dr. Moss' method of attack as evidenced by his paper was along the line of physiological determinations of fatigue as the result of driving or riding in cars under varying road and weather conditions, with different distances and rate of travel, and in different models of the same make of car.

Dr. Swope and Professor Jacklin, on the other hand, have been tackling the problem by dissociation of the variables, and studying each individually as to their effect on bodily discomfort. In this work they have been relying to some extent on the judgment of the subjects being used for the investigation, and while they have found that with respect to some of the variables, different reactions were obtained from different people, they found a number of "riding qualities" items on which rather general agreement was discovered. As far as those items are concerned, on the importance of which there seemed to be disagreement prevailing, it would no doubt be interesting to actually check mental judgment with definite instrumentation of the type Dr. Moss has been using in his work.

The variables in passenger car comfort on which Dr. Swope and Prof. Jacklin found personal judgment unreliable include the following:

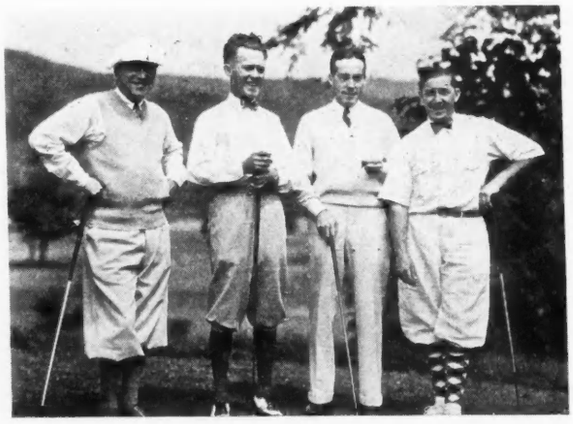
a. Swaying motion. b. "Roar" of car. c. Effect of clarity of vision. d. The effect of upholstery.

Good agreement was found by the investigators on the following items: a. Vertical motion. b. Body squeaks. c. Noise from engine. d. Noise from wind. e. Odors from engine. f. The "comfortable" quality of the seat. g. The roominess of the space in front of the seat.

The authors' investigation indicated further that influences extraneous to the vehicle itself have a decided effect in producing fatigue, depending for their evaluation on the personal characteristics of the test subject, and in many cases not at all on the vehicle.

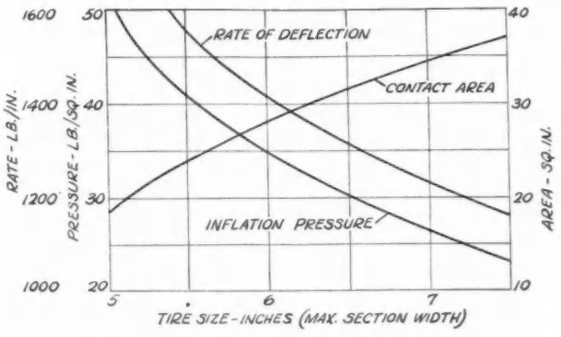
While this statement may appear rather obvious, it bears a considerable importance when the question of method of riding quality study is discussed. After all, what the car designer

### At White Sulphur They Hit 'Em Far and True



On the way 'round are N. B. Stevens of Firestone Tire & Rubber Co.; John Sneed, Steeldraulic Brake Corp.; J. B. Shea, another Firestone man, and L. L. Kinstler of Holley Permanent-Mold Machine Co. + + +

# Riding Qualities Classifies Types




**How width of tire affects contact area and rate of deflection when inflation pressures are such as to give equal proportional deflections + + + + + +**

wants to know is how to make his own vehicle more comfortable. He cannot control road and traffic or weather conditions, nor, for that matter, completely the speed at which the car is going to be operated, and the effects of speed in itself on the psychology or physiology of the passenger or driver in producing fatigue.

What he would like to know, for instance, is to what frequency, acceleration rate and amplitude of normal or harmonic vertical car motion he should strive in the design of a new model or in revising the existing type. He should know again, the relative fatigue-inducing qualities of variations in body dimensions, seating postures, noises, swaying motion, and a variety of other subjects that need not be enumerated here.

That disagreement in personal judgment as to the importance of certain variables in riding comfort can be found is again interesting, since this may mean either that these variables are relatively unimportant from a pure comfort angle, or that the human anatomy is not sufficiently in tune with the mental processes to be able to accurately distinguish either qualitative or quantitative variations. This assumes, of course, that the variables under discussion are not also variable as far as the complete cross-section of the driving and riding public is concerned.

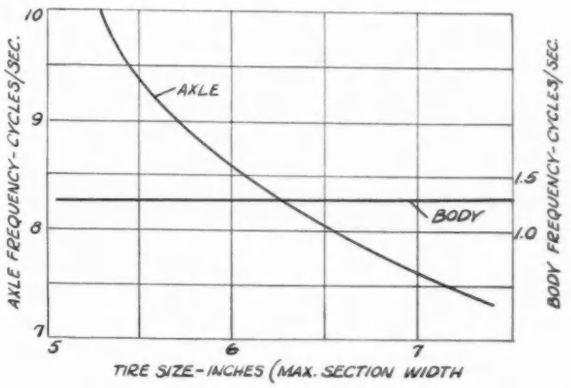
Among the points brought out in Dr. Moss' paper further apparent inconsistencies received discussion. Dr. Moss stated that in a number of tests he had found that front-seat passengers were more fatigued than rear-seat passengers, contrary to the generally accepted theory that more comfort is enjoyed in the front seat. This may be due, as Dr. Moss stated in the discussion, to the fact that front-seat passengers attempt to "drive" a car unconsciously, thereby adding mental or psychological fatigue to actual bodily fatigue. Or it may be due to engine noise, as Walter C. Keys, consulting engineer, Detroit, suggested.

A statement made by Dr. Moss in his address further corroborated Professor Jacklin in his statement regarding the importance of extraneous variables. Dr. Moss stated that the driver is generally more fatigued than the passengers, especially during the first hundred miles of a road test. An interesting observation made by Dr. Moss was to the effect that the normal individual showed greater steadiness on the wabblemeter at around 2 p.m. than in the early morning, if not subjected to fatiguing activity.

Professor Jacklin pointed out an interesting fact determined by tests on a specially constructed "shake table." This was to the effect that apparently the greatest personal tolerances to vertical vibration occur when the frequency is around 2 or 3 cycles per second. This shake table consisted of a platform carrying upholstered seats to eliminate the upholstery springs, etc., as variables. A motor drive was provided, arranged in such a manner that vertical amplitude of movement and frequency could be varied at will. Test subjects were asked their reactions as frequency and amplitude were varied.

In general, forces reported as disagreeable on the shake table were found to be much lower than those encountered at the same frequencies on a vehicle seat, determined by recording accelerometers of the solenoid type. The investigators concluded that this was probably due to the use of the hard chairs on the platform, where forces were not as well distributed as on a cushioned seat. Then, too, Dr. Jacklin observed, the forces and frequencies in a vehicle are continuously changing, whereas on the shake table they were held constant and repeated a sufficient number of times to permit the test individual to make a definite judgment regarding the quality of the discomfort.

In tests on vehicles conducted at the Indianapolis track with the cooperation of the Standard Oil Co. fleet, Dr. Swope and Professor Jacklin found that the body of a "dumm" or "mechanical" passenger is subjected to fairly large forces at frequencies of between 1½ and 16 per sec., while the feet of the




**Effect of tire size on rates of deflection of chassis and body + + + + +**

same passenger are subjected to greater forces at frequencies varying from 6 to 70 per sec., which, the authors suggested, may account for the fatigue occurring at the knees and ankles.

In the same series of tests it was noted that horizontal fore and aft as well as vertical vibrations, including their respective frequencies, were of considerable magnitude, and therefore suggested that this type of motion, both at the seat and floorboards, should also be considered in studies of riding qualities.

In the discussion of Mr. Brown's paper, Maurice Olley, Cadillac Motor Car Co., stated that the damping effect present with former high-pressure tires had been largely lost with the introduction of low-pressure tires, at the expense of riding qualities. Mr. Brown, however, thought that this damping effect was so small as to make little difference, considering the energy available for imparting shocks to the vehicle, and thus to the passenger. Mr. Brown, in answer to another discusser, also stated that wide rims contributed materially to good riding qualities.

B. J. Lemon, United States Rubber Co., in discussing Mr. Brown's paper, stated that traction depends mainly on the pressure available at the edge of the tread. Mr. Lemon also voiced a plea for more fundamental research on which to base load rating of present tires on smaller rim widths.

The use of a Westinghouse oscillograph, together with a microphone and amplifier, to study the effect of insulating and upholstering materials on body noises was mentioned during the discussion by Paul D. Paddock of the Mohair Institute.

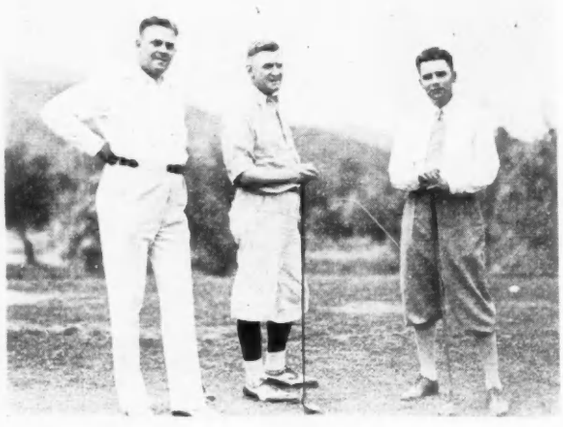
Following is an abstract of Mr. Brown's paper:

"The Tire Factor in Automobile Riding Quality" was discussed in a paper by Roy W. Brown, in charge of the engineering laboratories of Firestone Tire & Rubber Co. Mr. Brown pointed out that the difference between the shock the passenger receives and the blow caused by the road irregularity is largely dependent upon the combined cushioning properties of the tire, spring, shock absorber and seat cushion, and that it is evident that effective design can be based only on knowledge of the elastic properties of these components and of their interrelations. Fig. 1 herewith shows the relation between rate of deflection, contact area, inflation pressure and tire size for a medium-size passenger car. The graphs refer to six-ply tires, ordinary rim widths, and inflation pressures to give equal proportional deflections.

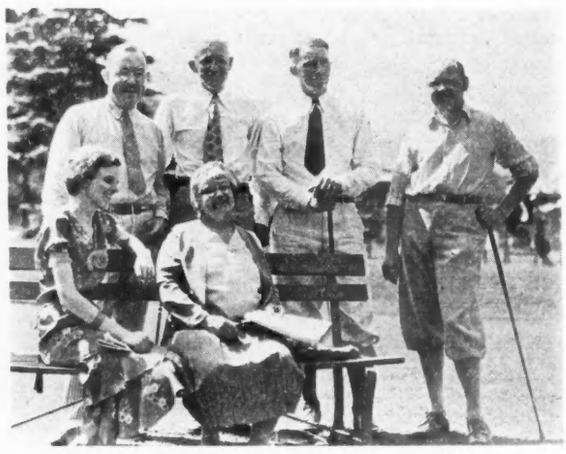
Rate is a more accurate index of the riding quality of a tire than its total deflection, for the reason that, especially in the cases of solid and cushion tires, the deflection does not increase uniformly with load. By the use of the Firestone solenoid accelerometer on cars on the road it has been found that the pneumatic tire load range is from 100 to 200 per cent of the static wheel load.

The effect of tire size on axle and body frequency can be readily determined by a series of tests, and the results of such a series, under the conditions represented by Fig. 1, are given in Fig. 2. It will be seen that the body frequency does not vary appreciably throughout the range of tire sizes, hence in this case any tire size may be used without a corresponding change in other parts of the chassis suspension.

The laboratory tests listed may answer the question as to the effect of the tire on the ride, but a final performance test under selected actual service conditions is highly desirable. The solenoid accelerometer provides a means of counting the number of accelerations and measuring their magnitudes. A test run should be repeated a number of times, to assure average results. Data may be conveniently presented graphically showing the number of accelerations per mile vs. acceleration in ft. p.s.p.s. However, no definite method of interpreting accelerations in terms of discomfort to passengers is available as yet.



Robert H. Daisley of Wilcox-Rich Corp., H. G. Jackson of Kelsey-Hayes Wheel Corp., and G. D. Weltz of Aluminum Co. of America, played well away from the rough + + + + + + + +



Just waiting to tee off are E. W. Austin, G. W. Waters, and P. C. Ackerman of Timken Roller Bearing Co., with J. A. Gelzer of Wagner Electric Corp., while Mrs. D. K. Moore and Miss Moore rest + + +

Diesel Engines

# Refiners Challenge Diesel Engineers To Build Engines for Cheaper Fuels

## Engineers charged with expecting oil technologists to produce fuels which would offset results of incompetent high-speed powerplant designs

FUEL refiners took engine designers to task at the Diesel engine session of the Summer Meeting of the Society of Automotive Engineers for assuming that refiners would eventually develop fuel oil which would make this type of engine more practical.

"Too often the oil man is asked to get the powerplant engineer out of troubles which have resulted from faulty design," A. Ludlow Clayden, Sun Oil Co., Philadelphia, told the session on June 15, at White Sulphur Springs.

"There is no economy in going to great expense to refine fuel for engines which, in the interest of economy, should be designed to operate on low-grade, cheap oils," he said.

Dr. O. C. Bridgeman, Bureau of Standards, emphasized the importance of determining viscosities of oils at "working temperatures" or at temperatures approaching those under actual operating conditions.

Speaking for engine manufacturers, Robert J. Broege, vice-president of the International Engineering Corp., said that hundreds of thousands of horsepower of Diesel type engines are being run all over the world without complaint. "Some units are being run on crude oil as it comes from the ground—simply strained to eliminate sand and rocks.

"It is reasonable to suppose that frequently some of the igniting oils removed by refining are mixed with the refined crude and sold for Diesel engine fuels," he continued.

W. F. Joachim, vice-president representing Diesel-Engine Engineering, presided

W. H. Butler, technologist, Standard Oil Co. of New Jersey, who read his paper on "Fuels for Automotive Diesel Engines," said he expected hydrogenation of petroleum products may yet offer a solution to the problem of fuel for the high-speed Diesel engine. "The process," he said, "is of sufficient flexibility so that it is possible that oils conforming to these requirements can be manufactured easily." Several companies are working along this line, he said.

After all, it was pointed out, the economy of Diesel type of engines is dependent upon the relative economy of fuel.

"The oil industry," the speaker said, "would like to see every possible effort made to utilize such fuels as could be processed and merchandised the cheapest."

Mr. Clayden urged Diesel engineers to develop engines which would utilize this low-priced fuel. "It is hoped that the engine manufacturers will not think their problem solved by turning over their troubles to the oil industry to solve."

Too often refiners have been called upon to produce fuels for Diesel engines without thorough knowledge of the characteristic problems of the powerplants for which they were supposedly to supply oils, Mr. Butler said.

"In my experience with various engineers who are designing high-speed Diesel engines, I find that the Diesel engineer appreciates his responsibility with regard to the fuel problem, and rapid strides have been made in the last two or three years in overcoming some of these.

"On the other hand, the petroleum industry has done little work in regard to developing a special fuel for this type of powerplant. That is, perhaps, only because they have not had close cooperation with engine designers."

He listed as major problems of developing proper high-speed Diesel fuels:

1. Clean burning and complete combustion.
   a. Smoke.
   b. Odor.
   c. Dilution.
2. Detonation.
   a. Combustion lag.
   b. Ignition.

Erich Sandner of Dortmund, Germany, wrote a paper which J. Barraja-Frauenfelder, consulting engineer, Philadelphia, presented, on Practical Experiences with Devices for Damping Torsional Vibrations.

The first part of the paper related to means for changing the critical speeds of rotating assemblies such as Diesel-engine marine installations, and the last part to vibration dampers for such installations. It was stated that the type of frictional vibration damper which has been so extensively used on automobile engines is not suitable for a 3000-hp. marine Diesel engine referred to in the paper, as with the very large

torsional moments on the crankshaft, overheating and cutting of the friction surfaces would soon set in.

A type of torsional vibration damper favored by the authors consists of a damper flywheel supported by a center keyed to the front end of the engine crankshaft, the flywheel being provided with internal gear teeth which mesh with pinions located in cylindrical chambers machined in the damper center near its circumference.

Drilled holes pass from the chambers in which the pinions are located to the bore of the hollow crankshaft. The whole assembly is enclosed within a housing which is filled with oil.

When there is torsional vibration the gear combinations act as oil pumps which draw in oil from the housing at one side of the line mesh and discharge it from the pump (pinion) chamber at the opposite side of the line of mesh. The oil is forced through a check valve in the end of the crankshaft into the housing. It does not seem that a vibration damper of this type were practical for ordinary automotive powerplants, owing to the complication.

Discussion following the presentation of this paper indicated that automotive engineers have found the Lanchester type of torsional vibration damper satisfactory for motor vehicle use.

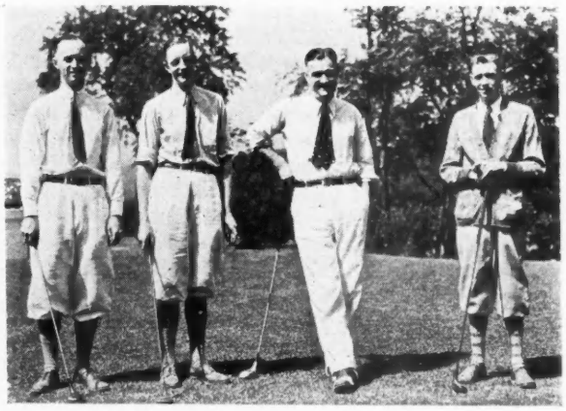
The Sandner device, as described by Mr. Frauenfelder, is capable of comparatively fine adjustment, which, although required when in a powerplant which operates at critical speeds for long periods, would not be required for automotive use where critical speeds are passed through rapidly, and then seldom at full throttle.

J. Ormondroyd, Westinghouse, declared in a written discussion that the complicated, expensive Sandner damper could find no place in automotive design.

The Sandner damping principle, Mr. Frauenfelder said, was being used on the four-engined Junkers aircraft as a coupling device between the engines and propellers. This, he said, made the operation of this type of craft possible after the use of other types of flexible couplings had proved to be impracticable.

# Some Summer Meeting Shots

The country surrounding the Greenbrier Hotel at White Sulphur Springs abounds in beauty spots + + + + + + + + + +



J. R. Hemeon, C. F. Ogren and C. A. Schell of the Thermoid Rubber Co., and J. P. Stewart of the Vacuum Oil Co. appreciated the links + + + + + + + + +

Walter C. Keyes, chairman at the New Developments session, went a-trouting here, and was host to some of his friends at an impromptu fish-fry + + + + + +

Transportation Session

# Bus Engineers Suggest Opposed Type Engines and Free Wheeling

## Members are startled by ideas proposed to eliminate design and operating objections inherent to motor coaches + + + + +

SUGGESTIONS for radical improvements in bus design made by D. A. Smith, general manager of the Detroit Department of Street Railways in his paper on the Utilization of Motorcoaches at the Transportation Session Monday were received with much favor by engineers of the bus manufacturing companies, many of whom indicated that several of the proposals made are either being carried out already or are being given serious consideration.

The significane of this will be appreciated when it is realized that Mr. Smith's suggestions included the possible use of engines of the opposed type mounted below the floor of the bus, of free wheeling, of radial cylindered engines, possibly of the Diesel type, of heating with steam, and of improved forms of gearset or the elimination of the gearset in the event that a suitable substitute can be found.

B. B. Bachman, vice-president of the Autocar Co., pointed out that engineers often are so close to their jobs that they are prone to neglect the use of their imaginations as Mr. Smith had done in making his interesting proposals. Mr. Bachman indicated that he agreed with nearly all Mr. Smith said, except as to decrease in weight of buses.

F. K. Glynn, chairman of the Transportation and Maintenance Committee, presided

Much of the discussion centered around the so-called "trolley-bus." Mr. Smith considers this type of vehicle likely to become a formidable contender in urban transportation, despite its inherent lack of route flexibility.

Its advantages, he pointed out, include several of the advantages of both the motorcoach and the trolley car, and it avoids some of the disadvantages of each. It is free from the unpleasant exhaust gas odors which constitute one of the most serious handicaps of the bus, is more nearly silent in operation, has less vibration and can accelerate rapidly, and its motors do not decrease the seating space within the body. F. C. Horner of General Motors expressed the view that most of Mr. Smith's suggestions can be complied with and that efforts in this direction already are being made, except as to weight reduction, and even in this respect he anticipates improvements. He feels, he said, that the trolley bus has a well defined field and that much has been accomplished with it already.

W. S. James, research engineer of Studebaker, asked to give his views on the application of free wheeling to buses, indicated that, although free wheeling doubtless could be used, so far as structural strength of gearset parts is concerned, it would be unwise to apply it to buses until more experience with this class of application had been gained.

H. C. Eddy, traffic engineer of the Board of Public Utility Commissioners of New Jersey, said that he, too, agreed with most of Mr. Smith's suggestions. He believes that there is a field for the trolley bus. He indicated that exhaust gas fumes in buses give rise to more complaints than any other factor, but that improvements aimed at keeping gas out of buses are being made gradually. Improved ventilation is needed and promising steps in this direction are being taken. Buses, he said, are still too noisy, both from the standpoint of passengers and from that of residents along bus routes.

Several speakers stressed the need for greater consideration on the part of bus operators for other users of the highways and especially for drivers of private cars. Much of the adverse legislation against buses is attributed to failure to insist that bus drivers be considerate in matters of this kind.

In closing the discussion, E. H. Libey, who presented the paper in Mr. Smith's absence, said he doubted that the gas-electric drive promotes economy. It is useful from the standpoint of ease in operation, but its cost and weight are serious handicaps.

An excellent paper on the Utilization of Motor Trucks by A. H. Gossard of the Middle West Utilities Co., not scheduled on the preliminary program, was highly praised by many truck engineers who attended the session, partly because of the extent and variety of data presented on cost of truck operation in many different classes of applications.

These data are based upon accurate records kept over considerable periods by the numerous subsidiaries of the company with which the author is connected and should prove exceedingly useful to all interested in the economics of truck operation, especially as related to use by public utility corporations.

Future Developments

# Rear Engine Mounting Would Give Passengers 50 Per Cent More Space

A NUMBER of good answers to the question "Why Not Put the Engine in the Rear of the Chassis?" which was the subject of Herbert Chase's paper, were given at the Future Developments Session, held on Wednesday morning and attended by a fairly representative audience, considering the opposing attraction of the golf links.

Mr. Chase favors a rear engine mounting and in his paper cited the following advantages as being obtainable with this form of construction:

A freer hand for the body engineer.

Odor, heat and noise are carried away from the passengers; possibilities for better streamlining.

A more compact and better balanced engine is possible.

Power-developing and transmitting units can be placed close together and still be made readily accessible.

No long propeller shaft is required and the chassis frame can be made lighter and integral with the body with considerable saving in weight of the assembled structure.

Increased riding comfort resulting from greater roominess of body and better location of seats in reference to the axles.

And cleaner external appearance.

It is contended by Mr. Chase that present conventional cars devote too large a proportion of the wheelbase to the engine and that a rearrangement of the chassis units will increase the space for passengers and baggage by fully 50 per cent without any increase in wheelbase.

This paper was followed by a lively discussion in which many engineers prominent in the Society participated. Although some objections were raised to various contentions made by the author, the general reaction seemed to be favorable and there was considerable support of the author's view that the proposed change may well prove highly beneficial to the automobile industry.

Austin M. Wolf, who opened the discussion, contended that several of the advantages cited by Mr. Chase could be obtained also by changes in the design of cars having the engine in front, including improved streamline form. He said also that with the engine in the rear a new driving technique might be required. It was possible, he added, to place the engine transversely in front and to take the power off at the center of the crankshaft, as proposed by D. H. Montgomery, even with the engine in front.

A written discussion submitted by F. H. Dutcher said that the author had built up an excellent case for the rear-engined car and pointed out that, although objections might be raised, some of them are likely to be merely arguments in favor of present vehicles and against anything "radical."

Mr. Dutcher, in common with several others, raised questions concerning weight distribution. This, the author admitted, would require some study. He said, however, that he did not consider it an insuperable difficulty, and pointed out that trucks and buses in which a large proportion of the weight is concentrated in the rear do not suffer from instability.

R. F. Anderson, speaking from the standpoint of a body engineer, said that the promised freedom from engine heat in the driver's compartment and the improved position of seats in reference to axles would be welcome, but he questioned whether a lighter frame could be used. Structural combination of body and frame is worthy of consideration, he said, but such an arrangement involves heavy die costs and makes it difficult to supply the varieties of bodies now demanded.

T. J. Litle expressed the view that the change involved in placing the engine at the rear of the chassis offers an opportunity which the industry should not pass up, as this is a time when something new is much needed to stimulate business. Rear engine cars, he added, offer an opportunity for simplifying the entire design of the vehicle, which means good engineering. Such cars are coming, he believes, and offer a great field for improvement.

Herbert Chase asked, "Why not put the engine in the rear?" + +

W. G. Wall stated that engineers are inclined to work along the lines of least resistance, as this is the simplest way, but there are many advantages in rear engine mounting, and that of greater comfort for the passengers cannot be stressed too much. The disadvantages of remote control and of a satisfactory drive to the wheels can be overcome, Col. Wall indicated, but he questioned the desirability of giving up the vertical type of engine and of concentrating weight behind the passengers.

A. Ludlow Clayden suggested that it might prove desirable to have the engine in the rear and drive to the front axle, and Joseph A. Anglada indicated that such an arrangement might tend toward greater stability. Mr. Anglada said that cars with greatly improved aerodynamic efficiency are unquestionably coming, although they may look queer at first. He also quoted parts of one of P. M. Heldt's articles in

*Automotive Industries* dealing with the stability of cars having weight concentrated in the rear, in order to show that this factor must not be overlooked.

H. T. Woolson expressed the view that, although cars probably are going to evolve in such a way that their streamline form will be improved, it is unwise to proceed too rapidly in this direction. He said that cars with rear engine mountings may not prove so quiet as anticipated and that the elimination of a long propeller shaft removes a desirable element of flexibility. He also voiced the possibility that an engine in the rear might increase danger to passengers in the event of headon collision as it has done in some airplanes.

D. P. Barnard stated that in fast driving with some cars wind eddies cause a terriffic din, much of which could be avoided by proper streamlining. He questioned, however, whether streamline forms of body will prove more stable than conventional ones in quartering winds and eddies such as exist when vehicles pass on the road.

In closing the discussion Mr. Chase said that the question of body heating need cause no apprehension, as either hot water or steam (in the event that steam cooling of engines is used in the future) can be piped through body radiators without difficulty. As to relative danger in comparison with conventional cars, he said that the comparison with airplanes which have a relatively weak frame is not justified, as the conditions are far from being parallel.

If the engine is properly anchored it will not come free of the chassis in any collision which would not throw the passengers through the windshield. Moreover a substantial bumper giving a degree of protection at least equal to that afforded in conventional cars should be provided in any rear-engined car.

In the paper on "The Field for Synthetic Lubricating Oils," presented by D. P. Barnard, the author described two synthetic lubricants having viscosity-temperature characteristics that make them especially desirable for use in shock absorbers, and gearboxes. Because of higher production costs such oils must be sold at a much higher price than those of the ordinary type, unless an unexpected demand develops. A. L. Beall said, in discussing the paper, that easy starting of aircraft engines without the need for preheating is becoming increasingly important. In consequence the new oils are likely to find use and fill a long-felt want in engines of that type.

J. H. McDuffee, general manager, Prest-O-Lite Storage Battery Co., being greeted by C. B. Whittelsey, Jr., and A. J. Underwood of the S.A.E. headquarters staff upon his arrival at White Sulphur Springs in his airplane + + + + +

F. K. Glynn (extreme left) and Mrs. E. P. Warner watching Mrs. E. S. Marks who competed in a stunt race during the S.A.E. field day + + + + + + + +

A mountain scene between Parsons and Thomas in the beautiful country surrounding the scene of the S.A.E. summer meeting + + + +

# Ratio of Oil Consumption to Mileage Greater at Higher Speed

*(Continued from page 982)*

R. E. Wilkins, Standard Oil Company (Indiana) gave some figures on oil consumption based on results of tests recently made at the Indianapolis Speedway. The average ratio of oil consumption at 55 m.p.h. to oil consumption at 30 m.p.h. for a considerable number of cars was 6.9.

P. J. Kent, chief electrical engineer, Chrysler Corp., presented a paper on Low-Temperature Starting Development of Automobile Engines. In the investigation on which the paper was based the following conditions were maintained:

1. Air, oil and cooling solution in the engine; storage-battery; starting-motor and the engine under test to be thoroughly chilled to 0 deg. Fahr. before each test is made.
2. A grade of winter oil having uniform physical properties was used for all cranking performance tests. In virtually all cases, tests were made with fresh undiluted oil and then duplicated with similar oil diluted with 15 per cent of kerosene. The latter probably represents the condition of oil in the average engine in winter time.
3. A grade of gasoline having uniform distillation-properties.
4. Battery performance as designated by Willard curves for new batteries at 0 deg. Fahr.
5. A uniform method of preparing the engine prior to making tests for cranking performance. This method will be described later.

Among the factors investigated was the capacity of the fuel pump. If this is less than the engine demand under choke at cranking speed, it should be at least sufficient so the float bowl will not be completely emptied if the engine is cranked until the battery voltage has dropped to 3 volts.

Mr. Kent said that in order to establish starting conditions at least as severe as those encountered by 98 per cent of car owners in winter time, they always strive to develop cranking equipments to give a minimum speed of 40 r.p.m. after the engine, oil and battery have stood for 24 hours at a temperature of 0 deg. Fahr., the oil in this case being the Chrysler standard winter test oil with 15 per cent of kerosene dilution, and the battery fully charged.

The procedure for determining the cranking speed, cranking current and voltage at the starter terminals under the standard conditions in the cold room were described in detail in the paper. Engines subjected to this test have previously had their friction horsepower reduced to the standard value by a running-in process outside the cold room. After the tests with diluted oil are completed the engine is tested in the cold room with fresh oil in the crankcase under otherwise the same conditions. The cranking speed is then usually only half as great. From the data thus obtained it is possible to decide upon the correct equipment, so far as initial cranking speed is concerned, or at least to narrow down the various optional combinations of battery, starting motor and gear reduction to two or three. Cost of equipment and relative cranking capacity will determine the final decision.

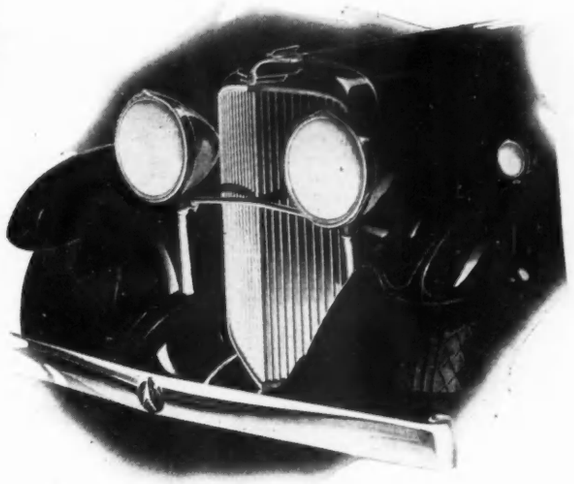
With any given starter, the torque at the starter pinion is dependent upon the current draw, and an equipment for measuring starter torque has been installed in the Chrysler laboratory. Once the relation between starter current and torque has been established, the torque required for cranking an engine at any given speed under the standard conditions can be found by merely measuring the current. Tests are also made of the cranking capacities of various starter and battery combinations under the standard conditions. A horsepower-demand vs. cranking speed curve is then drawn, and also a curve of horsepower available vs. starter current. From the latter curve the maximum horsepower available at the starter pinion may be found. This point is then transferred to the horsepower demand curve, and the corresponding cranking speed determined therefrom. This speed is divided into the speed of maximum horsepower of the starter, and the result is the ideal gear ratio for cranking under the standard conditions. With a direct-geared starting motor the range of gear reductions available is rather limited, and even with back-geared starting motors it is not always commercially practicable to adopt the ideal gear ratio.

Mr. Kent said there are three general classes of starter-control mechanisms in use today which (*a*) automatically engage and disengage the starting-motor pinion, (*b*) manually engage and automatically disengage the pinion or (*c*) manually engage and disengage the pinion and have an over-running clutch that releases the armature in the interval between the time when the engine starts firing and the manual disengagement of the pinion. Concerning these methods of starter control the author said:

"Without entering into a discussion of the relative advantages and disadvantages of the three types of control, I will say that our experience has left no doubt in our own minds as to the superiority of the third type so far as the winter-starting problem is concerned, particularly on the larger engines. When starting at low temperatures, very few engines will continue to run after the first explosion. However, with the positive control of the manual shift the pinion remains engaged and immediately picks up the engine until it is firing steadily. Further, in the case of the larger engines, while the torque from the initial explosion may momentarily exceed the cranking torque of the motor, it will not average as high, so that some outside assistance is required to keep the engine turning over until it is freed sufficiently to run on its own power. With the manual control, the starting-motor pinion ca nbe kept engaged with the flywheel, making it possible for the starting-motor to supply this outside assistance."

# Nash Adopts Synchronizing Clutches and Oil Temperature Control

## More complete body insulation, improved brakes, and shock absorbers are features of the offerings + + +



The three larger models have a V-type radiator + + + + +

ADOPTION of gear-synchronizing clutches in the transmissions of all models, the use of oil-temperature regulators throughout the line, more complete body insulation against temperature and noise, improved brakes, new radiators and front ends, improved shock absorbers, bullet-type headlamps, new fender lights, and new instrument panels with more legible instruments, are among the features of the Ninth Series of cars that are being introduced by Nash Motor Co.

Numerous other changes have been made on individual models, including a power increase on the lower-priced twin-ignition eight, now called the 980; the use of rubber shackling throughout on the L-head eight, or 970, and the six, or 960 model; the adoption of bonded rubber type torsional dampers on the 960, 70 and 80; combined intake silencers and air cleaners on the 970 and 980, and new fenders on the 970 and 960.

In appearance the three larger models are characterized by a new Vee-shaped front grid to the radiator. Shells are lacquered to match body colors on these cars, and trimmed off with chrome molding. On the six there is a vertical trim bar down the front of the core, the shell for this model being chrome plated. New ornamental filler caps are found on all models.

Bullet-type headlamps accompany the front end changes on all models, while bullet-type parking lights are also provided on the fenders of the eights, with streamlined indicator lights on the six. A further general change is in the adoption of single-bar bumpers front and rear on all cars. On the 990 the rear bumper is provided for mounting a trunk bumper bar for use when the trunk rack is down. Front license carrier brackets on all models have been moved over to one side, so as not to obstruct the pleasing radiator lines.

When wood wheels, either demountable or standard, are used on any of the new Nash models, hub bolts are concealed by cover plates. Running board moldings are deeper on the six and L-head eight, and fender flanges near the running boards have been made deeper on these models.

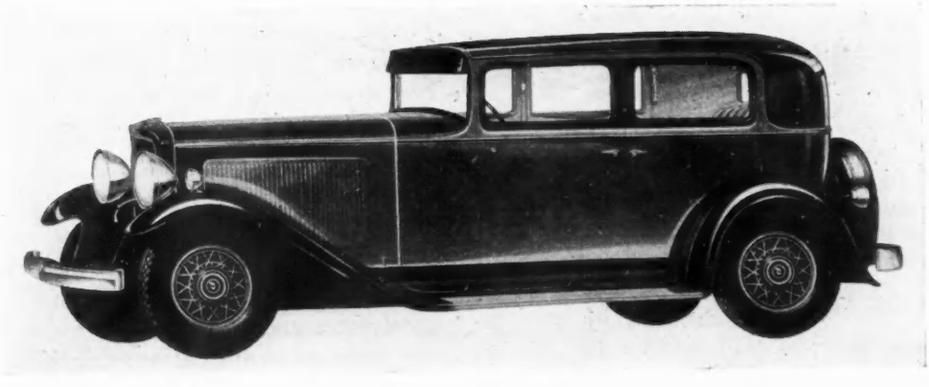
The new transmission combines the synchro-shift principle, which obviates the grating of gears in shifting, with a silent, helical-type second gear which makes second speed acceleration quiet. In addition, it gives the driver positive control of the car at all times, by enabling him to use the braking power of the engine.

The synchronizing mechanism consists of an arrangement of bronze-to-steel cone clutches inside of the transmission, which acts as a brake to control and equalize the rotating speeds of gears at the instant of shifting, so that their engagement is smooth and noiseless.

### Nash Six

Only a few changes have been made in the engine of the Nash Six, probably the most important being the use of a bonded-rubber type of torsional vibration damper. An important addition is an oil cooler mounted inside the water jacket cover at the side of the engine.

*(Turn to page 1012, please)*



In the 970 sedan there are overstuffed arm rests, smoking sets, assist cards, among its appointments + +

# Price Control May Damp the Business Cycle, Claims N. B. Gaskill

by Herbert Hosking

"OVERPRODUCTION is the necessary consequence of the search for abnormal profit on a volume basis," says Nelson B. Gaskill, former chairman of the Federal Trade Commission, who proposes* that we set up a method for controlling the business cycle before seeking to eliminate it. Control of price both upward and downward is the key to the situation, Mr. Gaskill believes, and its corollary is found in a proposition to establish the return of cost to each factor in the distribution scheme as the minimum of prices downward, and to leave competition, regulated by these terms, to control artificial price movement upward.

The Sherman Law, with its prohibition of combinations for the control of production, virtually enforces one phase of the business cycle, but the sweeping repeal of the Sherman Law barriers would be a "gesture of despair."

"The way out of the dilemma is not putting legal pressure on either phase of the business cycle as a separate and detached incident. On the contrary, the remedy is to set up a method of control over both the high and low phases of the business cycle, to deal with the extremities of high and low movements at the same time and in equal degree."

Before the Sherman Law was passed, Mr. Gaskill points out, it was more or less common practice, particularly among the manufacturers of branded merchandise, to sell it for resale under contracts which controlled the resale price to the consumer. Changing conditions of distribution threw a strain on this relationship when the dealer or distributor tried to obtain the advantage of maximum consumer demand, without restriction of price imposed by the manufacturers. The problem, with each interest standing on its property rights, got into the courts, where it has not yet been solved completely.

In an early Supreme Court decision, under the Sherman Law, the sole public interest was found to be in uncontrolled competition (right of the dealer to establish without interference the resale price of the manufacturers' product) and this assumption, Mr. Gaskill reasons, "continues to befog the vision down to the present day."

"The public interest in price control to prevent prices from being unduly enhanced remains unchanged, but it now appears that the public interest is also involved to prevent price from being unduly depressed. The prime cause of unduly high prices is found to lie in the necessity for unduly low prices. It is the integrity of privately-owned productive property which is to be conserved, rather than the business cycle. This is the new view of public interest which must be gained."

The new concept of the public interest seems, to Mr. Gaskill, to have two phases:

1. The preservation of individual freedom to have and hold productive property, and to use it without restraint . . . except that necessary to guarantee the same rights to other producers . . . and guarantee as a minimum return replacement of the effects in use . . . and subject ownership to competitive displacement in production and sale only on like terms.
2. Stabilization of the exchange of commodities so far as possible, out of the range of the alternation of profit and loss swings, in order to afford a more definite basis for the continuity of employment and the just determination of wage rates.

Under these conditions: "competitive survival will be stated in terms of efficiency as reflected by cost and the requisite margin, rather than by the ability to impose and sustain the greatest loss," with a conclusion that "freedom of trade is to be found in the universal requirement of replacement of the effect of use as the condition of the right to use productive property."

The practical working out of the above conclusions, Mr. Gaskill believes, will begin with legislative action

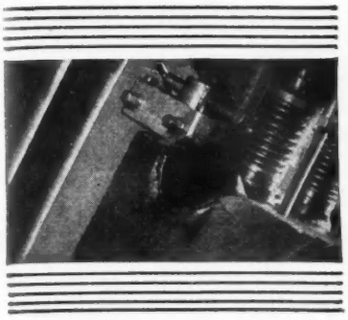
(*Turn to page 1014, please*)

*"Price Control in the Public Interest," by Nelson B. Gaskill, Washington, 1931.

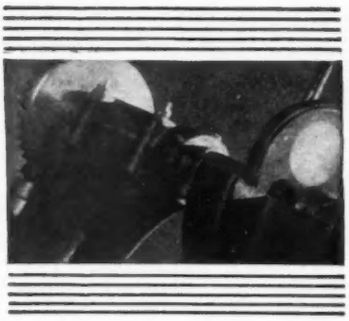
## Federal Regulation Difficult, Legislation Not Called for Says Trade Commission

**Declaring that no legislation permitting resale price maintenance is called for at present, the Federal Trade Commission has sent to Congress its concluding report on the investigation of that subject undertaken on the Commission's initiative.**

**The Commission believes it would be difficult to provide government regulation of price maintenance that would bring relief to makers of trademarked goods without injustice to consumers and at the same time meet the tests of practical administration.**



# NEWS OF THE INDUSTRY



## M. & E.A. Plans Two Bodies

### Wholesalers and Manufacturers to Separate Activities

NEW YORK, June 25—At a meeting of the Motor and Equipment Association councillors for divisions A, B and C, on June 23, and a meeting of the Motor and Equipment Association board of directors on June 24, 1931, it was decided, subject to appropriate action by the membership, that it would be to the best interests of the association to postpone the proposed federation plan and convert the present organization into two separate associations, one for the manufacturing members and another for the wholesaling members, according to an announcement from E. T. Satchell, president.

This conversion will take place on the basis of the membership of the Motor and Equipment Association as of June 24, although the present association and its board of directors and officers will continue to function until after this year's joint meeting of the M.E.A. and N.S.P.A. to be held at Atlantic City, Dec. 7 to 12.

The reorganization will afford the fullest opportunity to both associations — the manufacturers and the wholesalers, for all the contacts desired through joint committees and other dual meetings and there is a strong feeling on the part of directors and councillors that after prolonged and careful consideration, the best practical way has been found for affording both the manufacturer and the jobbing members a full and unrestrained opportunity to utilize all the benefits of an economy even greater than that which was obtained by way of the federated plan, according to Mr. Satchell's statement.

Details concerning the reorganization will be worked out by various committees that have been or will be appointed. The name of the organizations will be revised.

## THE NEWS TRAILER

THE Dodge marathon car completes the first year of its transcontinental weaving with 100,000 miles on the speedometer . . . on July 1 it will report at the factory for an official birthday party . . . after that, back to the roads *** Add Diesel developments . . . the Lufthansa airline between London and Berlin will put into operation Junkers planes with Diesel type engines . . . the last steam locomotive has disappeared from the streets of N. Y. to be replaced with modern Diesel-electrics . . . but the law still requires that a horseman with a warning device still ride in front of the engines . . . they are used in the hauling of freight cars along the Hudson river front of the city *** a 1903 one-cylinder Cadillac which was submerged for eight years in Cripple Creek, near Murfreesboro, Tenn., was recently salvaged, overhauled, and driven 700 miles to Detroit . . . according to the owner, Frank Wright of Murfreesboro, it averaged 20 m.p.h., consumed 2 gal. of oil, and got 40 miles to the gallon of gasoline, on the trip *** Frank H. Nutt, research engineer of AC Spark Plug, died June 23 at the Mayo Hospital . . . Mr. Nutt was formerly chief engineer for the old Haynes Automobile Company *** there is Henry Clay of Brownsville, Tex., who wrote the Chrysler factory for some parts for his Chrysler "70" . . . Mr. Clay had driven the car 365,000 miles, and feared that he would not be able to push it over the 400,000 mark unless he got a few new parts for it *** Prosperity note: enterprising citizen of Washington, D. C., got pot-boiler lease on plot of ground near Government bldg. and tried to sell parking space to government employees at 5 cents per day per car . . . but the employees wouldn't stand for the hold-up and decided to park on the nice free wide streets of "the village," as the old settlers call it *** On July 8, Dwight B. Huss, who 26 years ago drove an Oldsmobile "Old Scout" across the country to win the first transcontinental race against another merry Oldsmobile, will start out again in the same car over the same route . . . the first trip took 44 days . . . here is the account of the start as it appeared in the May 10, 1905, issue of *Horseless Age*, the rock upon which *Automotive Industries* was founded: "From New York to Portland, Ore., in forty-one days or less, is the program outlined for the drivers of two Oldsmobiles which started at 9.25 o'clock on Monday morning from the Oldsmobile agency at Fifty-ninth Street and Seventh Avenue, New York. One of the vehicles was in charge of Percy Megargel, who drove an Elmore car from New York to St. Louis and back last year, and with him was B. Stanchfield, a mechanic, as second and aide. This car was named 'Old Steady.' The other car, named 'Old Scout,' was in the care of Dwight B. Huss, who has driven Oldsmobiles in several American races.—H. H.

## Reo Voting Trust Dissolved

### Wilson Notifies Stockholders of Action

LANSING, June 25—The voting trust formed for Reo Motor Car Co. stock Feb. 12, 1930, and originally intended to extend until Dec. 31, 1932, has been ended under the terms provided for anticipating its termination, it was announced at the close of last week.

In a statement to certificate holders telling of the release of their shares, William Robert Wilson, vice-president and general manager of the company, stated that the purpose of the trust had been accomplished and that there was no need of further continuance.

## A.S.T.M. Elects

PHILADELPHIA, June 25—Frank O. Clements, technical director, General Motors Research Corp.; Arthur W. Carpenter, manager, testing laboratories, B. F. Goodrich Corp., and J. B. Johnson, chief, material branch, United States Army Air Corps, Wright Field, have been elected to various offices by the American Society for Testing Materials. Mr. Clements was made president, and Messrs. Carpenter and Johnson were elected to the executive committee.

## May Sales Show Drop

PHILADELPHIA, June 25—Registrations of passenger cars in 38 states point to a May sales total of 250,000, a 28 per cent decrease from May, 1930, and a loss of 6 per cent from the 265,732 cars registered in April of this year. Chevrolet has a 6 per cent lead on Ford in the states which have reported to date and is only 1½ per cent behind May last year.

## Morgan is Elected

NEW YORK, June 24—Thomas A. Morgan, president of North American Aviation, Inc., has been elected president of the Curtiss-Wright Corp.

# Men of the Industry and What They Are Doing

## V. I. Montenyohl Succeeds Mahony

V. I. Montenyohl, treasurer of the B. F. Goodrich Co., will succeed P. R. Mahony as executive vice-president of the International B. F. Goodrich Corp., it was announced by J. D. Tew, president of the two companies.

Mr. Mahony's resignation, effective June 15, was accepted, and offices of the corporation will be moved from New York to Akron, Ohio. Mr. Montenyohl will continue as Goodrich treasurer.

## Weekes Sails for Russia

Charles P. Weekes, vice-president in charge of Eastern sales for the Hercules Motors Corp., sailed June 4 for Russia where he will spend several weeks in the interests of his organization.

During Mr. Weekes' absence, A. B. Wehling will have charge of the Hercules Motors Corporation's Eastern office.

## Rustless Names Field

Rustless Iron Corp. of America has appointed Alexander L. Field as director of development and research. Mr. Field was formerly research engineer of the Simonds Saw and Steel Co. He has also been connected in the past with the Union Carbide and Carbon Corp. and a number of its subsidiaries, also the Central Alloy Steel Corp.

## Hercules Names Two

W. W. Cromley, for many years identified with the internal combustion engine industry, has joined the Hercules staff of sales representatives, while Harry E. Blasingham has recently been appointed general purchasing agent in entire charge of all Hercules purchases and stores.

## Daley Leaves Multibestos

Thomas J. Daley, who has been connected with the Multibestos Co. for a number of years, lately handling equipment items in the Detroit area, has announced his resignation from the company. Mr. Daley has not announced his future plans.

## Olds Names Greene

Burch E. Greene has been appointed sales promotion, Olds Motor Works, succeeding P. C. DeBarry, according to an announcement by J. T. Collins, general sales manager.

Mr. Greene has been a dealer for several years and more recently engaged in sales promotion management with other car manufacturers.

Mr. DeBarry has been named manager of the Cincinnati Zone of Olds Motor Works. He already has assumed his new duties.

## Wins Awards

**Norman G. Shidle**

directing editor of Automotive Industries, and other Chilton Class Journal Co. publications, who has received editorial awards of Associated Business Papers.
See Story page 1005 + + +

## Studebaker Names Frank

Arvid L. Frank has been made vice-president and general manager of The Studebaker Pierce-Arrow Export Corp. He succeeds H. S. Welch in the general management of the company. Mr. Welch has resigned his connection with the corporation, effective July 31.

Mr. Frank has been connected with The Studebaker Pierce-Arrow Export Corp. for the past five years in various capacities, the most recent of which was as sales manager.

## Reo Truck Business Up

DETROIT, June 22—Retail deliveries of Reo Speed Wagons and trucks for the week ending June 5 were greater than any previous week this year.

# Executives View Future Transport

### Railroad and Automotive Group Look to Common Problems of Future

NEW YORK, June 23—Executives of the motor industry met with executives of the railroad industry last week for a discussion of the future transportation, so far as it affects both industries.

The purpose of this meeting was for the consideration of general transportation with a view to reaching a clearer understanding of their common problems. While no definite conclusions were reached at the meeting, groundwork was laid and it is expected that future conferences will be held.

The motor industry was represented by A. J. Brosseau, president of Mack Trucks; Alfred H. Swayne, vice-president of General Motors; R. P. Page, Jr., president of Autocar; T. R. Dahl, vice-president of the White Co.; Walter P. Chrysler, president of Chrysler Corp.; Byron C. Foy, president of De Soto; Paul W. Seiler, president of General Motors Truck; Alfred Reeves, general manager of National Automobile Chamber of Commerce; Pyke Johnson, the Chamber's Washington representative; Edward F. Loomis, manager of the Truck Department of N.A.C.C.; and La Rue Brown, counsel for the N.A.C.C.

The railroad industry was represented by P. E. Crowley, president of the New York Central; Daniel Willard, president of Baltimore & Ohio; C. W. Galloway, vice-president of Baltimore & Ohio; Hale Holden, president of the Southern Pacific; Ralph Budd, president of the Great Northern; W. R. Cole, president of the Louisville & Nashville; Elisha Lee, vice-president of the Pennsylvania; C. E. Smith, vice-president of New York, New Haven & Hartford; J. J. Bernet, president of the Chesapeake & Ohio; P. J. Neff, assistant vice-president of Missouri Pacific; S. T. Bledsoe, chairman of executive committee of the Atchison, Topeka and Santa Fe; M. J. Gormely, executive vice-president of the American Railway Association; and R. H. Aishton, Alfred P. Thom and Dr. C. S. Duncan of the Association of Railway Executives.

## Efficiency Tool Reorganizes

DETROIT, June 23—Efficiency Tool Co., formerly of Kokomo, Ind., has reorganized under the name of Riess Efficiency Tool Co., and moved to Sturgis, Mich. Frank Riess is president of the new company. The company, who manufacture power screwdrivers, are bringing out a new tool for heavy duty use in factories.

# Rails Widen Use of Unit Stock

## American Lines Now Have 730 Rail Motor Cars in Operation

CHICAGO, June 25—In an effort to counteract declining passenger revenues, particularly on branch lines, 62 railroads of the United States, Canada and Mexico have, since 1923, installed in service 730 rail motor cars, according to a report submitted at the closing session in Chicago yesterday of the Twelfth Annual Convention of the Mechanical Division of the American Railway Association.

Of the total number of railroads, 58 located in the United States have placed in service 673 rail motor cars, while three Canadian roads have installed 50 and one Mexican road, seven.

For the most part these cars are being operated on lines where traffic is light and as a substitute for steam trains. The cars vary in size but for the most part they have a seating capacity ranging from 40 to as high as 121 passengers.

The report was submitted in behalf of the Committee on Automotive Rolling Stock by the Chairman P. H. Hatch of New Haven, Conn., engineer of automotive equipment of the New York, New Haven & Hartford Railroad Co.

## Highway Contracts Made

WASHINGTON, June 23—Contracts for public and semi-public construction projects totaling $88,540,234 were reported to the Public York Section of the President's Emergency Committee for Employment last week. The addition of this amount brought the total volume of contracts reported since Dec. 1, 1930, to $1,768,385,499. The week before last, $29,234,467 worth of contracts were reported. The reports of last week include state and federal-aid highway construction contracts awarded in 27 states, totaling $64,193,390. Another item of $1,233,000 included in the total is the balance of the emergency appropriation of the Section on Rivers and Harbors, United States Gorps of Engineers. This sum has been allotted for work in various states.

## Committee Changes Made

PHILADELPHIA, June 22—Several changes in the personnel of the Standards Committee of the Society of Automotive Engineers were approved by the council at the Summer Meeting of the Society, held at White Sulphur Springs, W. Va., June 14-19. Leonard Ochtman, Jr., chief engineer, Elco Works of the Electric Boat Co., and chairman of the motorboat and marine engine divisions, standards committee, has resigned as chairman of the division. The work of the chair will be carried on by vice-chairman N. E. Donnelly.

R. E. Wilson, Standard Oil Co. of Indiana, has resigned as chairman of the lubricants division. Daniel P. Barnard, IV, has been appointed to succeed him. Mr. Barnard is research engineer for Standard Oil of Indiana.

D. W. Ovaitt, efficiency engineer, Buick Motor Car Co., has been named to represent the S.A.E. on the Sectional Committee on Leather Belting.

## Cousino Patent Upheld

CHICAGO, June 22—In a memorandum issued June 8, Lindley, J., of the U. S. District Court for the Northern District of Illinois, Eastern Division, in the matter of the International Spotlight Corp. and the Lorraine Corp., plaintiffs, and the United Mfg. Co., defendant (Equity No. 9426), it was noted that a decree would be handed down "finding claims 5 and 6 of the Cousino patent (controlled by plaintiffs) valid, infringement thereof by the defendant, and for an accounting."

In the above case the plaintiffs (controlled by the Van Sicklen Corp.) brought suit in equity to recover for infringement of patents on a dirigible spotlight, held by Cousino et al. The defendant denied the validity of all the patents cited by the plaintiffs and infringement of certain ones thereof. In a counterclaim, it charged plaintiff with infringement of five patents, two of which were relied upon at subsequent trial.

The court reviewed all the patents cited in both actions for priority of invention and validity. In his decision Judge Lindley said:

"There remains only the question of infringement of the Cousino patent by defendant. It appears from an examination of the device manufactured by the defendant that it embraces every element of Cousino, substituting only certain mechanical equivalents for certain ones in the latter's invention; that the specific combination to which Cousino must be restricted is infringed by defendant."

## Hudson Wayne Sales Up

DETROIT, June 22—Sales of Hudson and Essex cars in Wayne County during the first two weeks of June show an increase of 20 per cent over the corresponding period in 1930, according to a report by Aaron DeRoy, president of Aaron DeRoy Motor Car Co., Hudson-Essex distributors.

## Develop New Taximeter

NEW YORK, June 22—Checker Cab Mfg. Corp., in conjunction with the Pittsburgh Taximeter Co., has developed a new taximeter which is operated by the passenger electrically.

# Shidle Honored by A.B.P. Awards

## Directing Editor of Chilton Publications Wins Editorial Prizes

NEW YORK, June 20—Norman G. Shidle, directing editor of *Automotive Industries*, won the first prize in the Associated Business Papers, Inc., annual awards for editorial excellence, for a series of articles he wrote on automotive parts merchandising, it was announced today. He also won second prize for an editorial he wrote for *Automotive Industries*.

The awards, established in 1926, are offered annually to members of editorial staffs of nearly 150 technical and trade magazines which are members of the A.B.P., and carry prizes of $300, $150 and $50 respectively for the best article or series of articles and for the best editorials submitted. Mr. Shidle has been the only one to win two prizes in the same year.

Formerly editor of *Automotive Industries*, Mr. Shidle has been directing editor of the Chilton Class Journal publications for the past four years, and contributes regularly to these publications.

The series on parts merchandising appeared in *Automotive Industries* on May 17, 24, 31 and June 14, and discussed the trend toward the manufacture of automotive parts by independent manufacturers.

The author pointed out how automobile factories had allowed this business to go to the independent manufacturers by failing to properly merchandise replacement parts and showed how some factories had been trying to retrieve a large portion of this business.

The editorial, which appeared on the weekly "Just Among Ourselves" page, discussed the problem of merchandising machine tools with charges for special tooling and engineering prorated against standard and special equipment alike.

He suggested that both the machine tool manufacturers and purchasers of this equipment would make more profit if the equipment were sold at a basic price, plus the actual engineering and tooling costs involved on the machine sold.

Honorable mention in the editorial classification was awarded to C. K. MacDermut, Jr., managing editor of *Dry Goods Economist*, published by the United Business Publishers, Inc., which controls the Chilton Class Journal Co.

## Diamond Registrations Gain

NEW YORK, June 22—Diamond T Motor Car Corp. reports that its new registrations during April showed an increase of 64 per cent over the month of March.

# Traffic Managers Discuss Rates

## Regard Application of Rails for Blanket Increase Doubtful

DETROIT, June 23—At the traffic managers meeting of the National Automobile Chamber of Commerce here yesterday the railroads' application for 15 per cent increase in freight rates was discussed and strong doubt expressed that the proposed increase will accomplish the desired result. A possibility of an increase reacting in favor of rail competitors by expansion of traffic losses was mentioned and the meeting reviewed the possibilities of further rail operating economies in addition to potentialities of transportation coordination. The Interstate Commerce Commission hearing originally scheduled for June 9 on railroad proposal requiring payment of higher minimum weight than heretofore when carriers furnished cars longer than ordered by shippers, has been postponed until September.

The N.A.C.C. traffic department was instructed to intervene in connection with a complaint filed by Idaho Public Utilities Commission with the Interstate Commerce Commission attacking rates on automobiles from Detroit, Toledo, Auburn, Racine, etc., etc., to destinations in Idaho. Reports were given on status of plate and laminated glass automobile parts in mixed carloads, wooden packing box and crate material and other materials used in manufacture and shipping.

Among factories represented at the meeting were Auburn, Buick, Cadillac, Checker Cab, Chevrolet, Chrysler, Dodge, Federal, General Motors Truck, General Motors Traffic Association, Graham-Paige, Hudson, Hupp, International Motor, Lincoln, Oakland, Reo, White, and Willys-Overland. F. L. Starck, G. L. Middleton and K. A. Moore, of the conference, were present.

## Packard Prices Set

DETROIT, June 25—Prices on the new series of Packard cars, described in *Automotive Industries* for June 20, page 957, are as follows:

Five-passenger sedan on 129½ in. wheelbase, $2,485; seven-passenger touring, $2,775; five-passenger phaeton, $2,650; five-passenger sport phaeton, $2,950; two or four-passenger coupe-roadster, $2,650; five-passenger convertible Victoria, $3,395; five-passenger convertible sedan, $3,445; two-passenger coupe, $2,675; five-passenger coupe, $2,795; five-passenger club sedan, $2,775; five-passenger sedan, $2,685; seven-passenger sedan, $2,885; seven - passenger sedan - limousine, $2,985. All the above except the first are on 136½ in. wheelbase. The de luxe line on 142⅛ in. wheelbase follows: seven - passenger touring, $3,795; five-passenger phaeton, $3,690; five-passenger sport-phaeton, $3,990; two or four-passenger coupe roadster, $3,750; five-passenger convertible Victoria, $4,495; five-passenger convertible sedan, $4,450; two-passenger coupe, $3,725; five-passenger coupe, $3,850; five-passenger club sedan, $3,890; five-passenger sedan, $3,845. The following are on 146⅛ in. wheelbase: seven-passenger sedan, $4,150; seven-passenger sedan-limousine, $4,285.

## Toledo Companies Merge

TOLEDO, June 24—Unanimous approval to the merger of the City Machine and Tool Co. and the City Auto Stamping Co. was voted by stockholders at a special meeting this afternoon. Under the latter name the merger will be effective July 1. The capital was increased to 375,000 shares of no par common for which shares of the two constituent companies will be exchanged on a share-for-share basis.

The merger was dictated largely by development of a new radiator shell method of manufacture owned by the die company and used by the stamping company.

## Mack Looking for Dominion Output

NEW YORK, June 22—A. V. Harburn, Mack Trucks of Canada, Ltd., has announced that plans are being developed for the manufacturing of Mack trucks in Canada. The plant for this operation will probably be located in Toronto.

## Sales Set Record

CHICAGO, June 22—Perfect Circle Co. sales in May established a new high record with a gain of 26 per cent over the same period last year and an increase of 31 per cent over April, 1931, Lothair Teetor, vice-president in charge of sales, announces.

## Drop Forgers Plan Survey

CLEVELAND, June 24—According to an announcement by C. H. Smith, president American Drop Forging Institute, the drop forging industry has started a comprehensive survey in cooperation with the Department of Commerce. The objective is a self-examination leading to simplification of practice, accounting methods, etc., paving the way to more profitable operation.

## Russell Business Gains

NEW YORK, June 22—Russell Mfg. Co. did more business during April and May than they did during the first three months of the current year by a wide margin, it was announced at a divisional meeting held at Middletown this month.

# May Equipment Business Held

## The Month's Figure Was Close to April; Last Year Saw Drop

NEW YORK, June 24—May business in Parts and Equipment held even with April business this year, as compared with a marked drop in May of last year, according to monthly index figures prepared by the Motor and Equipment Association. The grand index for the whole industry based on January, 1925, as 100, was 124 in both April and May this year, as compared to 144 in May of last year, and with 163 in April of last year.

Both original equipment and service parts showed increases in May of this year, as compared with a marked drop in May of last year, but accessories and service equipment declined this year, while service equipment also declined last year. The May index for original equipment is 129, as compared with 127 in April; 153 in May of last year and 175 in April of last year. The service parts index for May is 128, as compared with 127 in April; 137 in May of last year and 150 in April of last year. Accessories made an index of 61 in May, as compared with 66 in April; 78 in May, 1930, and 74 in April, 1930. Service equipment index was 117, as compared with 118 in April; 165 in May, 1930, and 180 in April, 1930.

Sales by wholesalers during the month established an index of 100, compared with January, 1928, as compared with 105 in April and 119 in May of last year. Accounts receivable on wholesalers' books also showed a decline for the month.

## Motor Shares Resist Assault

NEW YORK, June 24—Eight out of seventeen stocks of automotive companies have maintained higher market prices during the recent period of low prices than they did during the 1920-1921 depression, according to a compilation prepared by Frazier-Jelke & Company, New York bankers. Allowance is made in this compilation for stock split-ups and stock dividends made during the intervening period.

Companies maintaining a higher level during the recent low point than they registered in 1920 and 1921, are: General Motors, Mack Trucks, Motor Wheel, Packard Motor Car Company, Reo Motor Car Co., Spicer Manufacturing Co., Studebaker Corp. and Timken Roller Bearing Co.

Stocks reaching a lower point this year than in the earlier period are: Continental Motors, Hudson Motor Car Co., Hupp Motor Car Co., Kelsey-Hayes Wheel Corp., Stewart-Warner Corp., United American Bosch Co., White and Willys-Overland.

# Airlines Set New Record

## Mileage in Month of April Tops Mark of July, 1930

NEW YORK, June 24—American air lines flew more miles during April than in any previous month in the history of air transportation, according to a report just issued by the Aeronautical Chamber of Commerce.

The total mileage flown in April by the 36 transport companies reporting to the Chamber was 3,412,594. This figure tops the previous peak of 3,098,570 miles, established in July, 1930, by 314,024 miles, and the April, 1930, mileage by 1,179,560 miles.

Air mail and express poundage carried in April, this year, showed a decided increase over that handled by the transport lines in the same month last year. Air mail reached a total of 795,539 lb. this year, as compared to 706,375 last; express poundage jumped from 26,814 to 59,165, an increase of more than 100 per cent.

The volume of passenger traffic handled by the major air lines also showed a considerable increase in April this year over the same period in 1930.

## Nash Goes on the Air

NEW YORK, June 26—Nash Motors Co. will inaugurate a radio broadcasting program, starting on Tuesday evening, June 30. The Nash program will combine musical and dramatic features, and will be known as the "Nash Parade of Progress." This will be broadcast over the red network of the N.B.C. at 9 p. m., Tuesday, Eastern daylight time.

## Heath Aircraft Moves

DETROIT, June 23—Heath Aircraft Corp., formerly of Chicago, has reorganized and moved to Niles, Mich. The company manufactures Heath Parasol airplanes.

The new officials of the company, under the reorganization, follow: president, Gen. John B. Clinnen; vice-president, W. A. Clinnen; secretary-treasurer, Jas. F. Morrison; chief engineer, F. E. Seiler; assistant engineers, Charles Morris, C. Linstedt; superintendent, C. Duke Muller, and sales manager, R. J. Byrnes.

## Peerless Sells Parts Stock

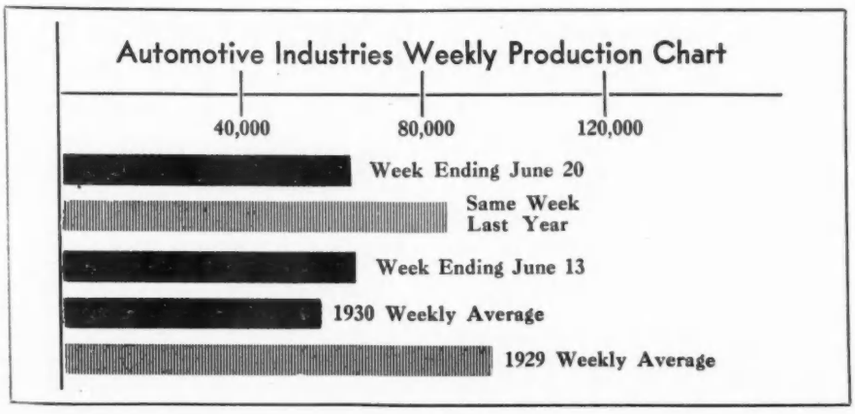
CHICAGO, June 22—General Parts Corp. has purchased the parts inventory of the Peerless Motor Car Corp., according to official announcement yesterday. Under this arrangement, service parts on all Peerless models up to this time, will be provided by General Parts Corp. It is understood that the purchase was made on an advantageous basis and that the bulk of the purchase price will be paid out of sales in Peerless parts as they are made.

## Czech Companies Agree

WASHINGTON, June 22—Three of the largest Czechoslovak automobile manufacturing companies, Prage, Skoda and Tatra, have agreed in principle to establish a joint production and sales organization, according to a cable to the Automotive Division, Department of Commerce, from Acting Commercial Attache S. A. Woods, Prague. The purpose of the agreement is to accomplish rationalization of the companies and to reduce overhead expenses. Although particulars of the general agreement have not yet been determined, it is understood the joint organization will begin operations on Jan. 1, 1932.

## Rubber Consumption Up

NEW YORK, June 22—Consumption of crude rubber by manufacturers in the United States for the month of May was the highest for any month since May a year ago and is estimated to be 37,817 long tons, an increase of 13.5 per cent over the April consumption of 33,321 long tons, according to statistics released by the Rubber Manufacturers Association today. Imports of crude rubber for May amounted to 31,720 long tons, the lowest figure since August, 1928, and compares with 46,648 long tons for April and 40,745 long tons for May, 1930.




# Automotive Steel Demand is Steady

## Large Buyers Still Getting Price Concessions, is Report

NEW YORK, June 25—While the effect of the proposed reparations holiday and of the ensuing revival of confidence in the business outlook was more directly noticeable in the nonferrous division of the metal market than in the steel situation, sentiment in the steel market in spite of unchanged midsummer dullness was also decidedly improved. Broader commitments on the long side in the London copper market caused the price for the red metal here to advance ½c.

Tin, for the same reason, scored a rise of a full cent. The leading lead producer marked up his price fully $5 a ton. The latter move, however, was rather coincident with the bullish tone of securities and commodities markets generally than solely due to this condition. A considerable amount of spot July and August lead was bought by consumers, among them storage battery manufacturers, on news of shutdowns of large western smelters followed by reports of heavy needs by public utilities. Zinc, more or less under the influence of European conditions in the zinc-consuming industries, rose a fraction.

Little change is noted in the rate of operations of steel mills catering to automotive demand. A good deal of business on which immediate shipment is desired and small backlogs of routine commitments cause daily fluctuations in operating rates. Prices for cold-finished steel bars continue unchanged for third quarter on a basis of 2.10c, Pittsburgh, with large buyers undoubtedly obtaining $1 or $2 per ton concessions for the time being. On the hot-rolled raw material, however, quotable at 1.65c, Pittsburgh, concessions are no longer as numerous as they were a few months ago, and it is quite possible that the market for the cold-finished product will grow firmer in consequence. Developments have encouraged sheet producers in confidently expecting the recently announced third quarter price advances to become fully operative.

**Pig Iron**—More third quarter inquiry is noted in the Middle West. The impression prevails that the Tariff Commission's report on pig iron under the flexible provisions of the 1930 Act will result in no change from the present rate of duty of $1.12½ per ton.

**Aluminum**—Latest returns of exports from Canada show that while shipments from that country in May were half the tonnage exported in May, 1930, they were two-and-one-half the tonnage exported in the preceding month. Prices are unchanged, with the demand routine in character.

**Copper**—The first direct result of the advance in the copper market was an upward revision by wire drawers of their base price to the extent of ¼c. Alloy foundry ingots were advanced to the same extent.

# Rails Are Asked To Define Request

## I. C. C. Seeks Information On Possible Advance On Vehicle Shipment

WASHINGTON, June 25—The railroads have been asked by the Interstate Commerce Commission if they propose to increase freight rates on automobiles. Agricultural, iron and steel, non-ferrous metals, lumber, petroleum and class rates also are included in the specific groups named by the commission on which it seeks definite information before proceeding with hearings in the so-called 15 per cent advance rate case. With this information filed by July 3, the commission will have before it what approaches a bill of particulars from the railroads to supplement its general statement carried in its petition asking for increased rates. Shippers of automobiles and other products also will be saved much time and expense if it turns out that some or all of the rates on their products are not to be affected.

The list includes products on which the railroads have within comparatively recent time reduced rates voluntarily. Reductions in rates on automobiles, for example, have been made in wide areas, including official classification territory, especially central freight territory, and in the southwest. The assumption is that the railroads do not propose to retrace their action and restore, much less advance, the old rates. This may happen in certain instances, such as for long hauls where motor truck competition is not so keen as it is on short haul rates. It is assumed that reduced short haul rates on automobiles and other products will be let stand as they are.

## Schutte Receiver Files

LANCASTER, PA., June 22—The Farmers Trust Co. of this city, permanent receiver for the Schutte Body Corp., has announced filing of its final accounting as receiver for the corporation. Unless exceptions are filed before July 11, the accounting is expected to be confirmed by the Court of Common Pleas, and distribution of any balance of the assets of the company will be made. Claims under the accounting must be presented before the above date by claimants in person or through counsel.

## G.M. Sells Glass Plant

NEW YORK, June 22—General Motors Corp. has agreed to sell to the Libbey-Owens-Ford Co. of Toledo, the plant of the National Plate Glass Co. located at Ottawa, Ill. In connection with this sale, General Motors is entering into an agreement to purchase a large part of its glass requirements from Libbey-Owens-Ford for a period of seven years.

With this addition to Libbey-Owens-Ford layout, the latter company will have plants in Ottawa, Toledo, Rossford and Lancaster, Ohio, Charleston, West Virginia and Shreveport, La.

The properties purchased at Ottawa include two complete manufacturing plants. One of these is now in full operation and has a capacity of 20 million square feet a year. In addition to the two plants, Libbey-Owens-Ford acquires valuable sand deposits of the Ottawa properties.

## Packet Tariffs Reduced

WASHINGTON, June 25—The Interstate Commerce Commission last Saturday granted short notice applications of the Baltimore Steam Packet Co., and the Chesapeake Steamship Co. of Baltimore to reduce rates by $1 and $2 per automobile or chassis between Norfolk, Va., and Virginia destinations and Baltimore. The reduction of $1 has been applied to shipments from Norfolk to Baltimore on both lines. The $2 reduction covers shipments from Norfolk on the Chesapeake Steamship Co., to Allmonds, Clay Bank, Gloucester Point, West Point and Yorktown, Va.

## Curtis Organizes Company

NEW YORK, June 22—Curtis Mfg. Co. has been organized as a Delaware corporation, with headquarters at Los Angeles, Calif., to take over the manufacturing operations of the Betts-Curtis Motors, Inc., of Long Beach, Calif., and a wide variety of patents owned by Harry E. Curtis, covering various phases of motor vehicle construction.

The new company plans immediately to go into production on trucks, having orders on hand for approximately 1000 units. It also plans in a short time to go into production of passenger cars, using the Curtis patents.

Capital stock of the company calls for 150,000 shares of no par, class "A" stock; 100,000 shares class "B" stock at no par, and 100,000 $5 par, class "C" stock.

Officers of the company are: W. B. Hambly, formerly vice-president and general manager of the Sterling Motor Truck Co., of California, as president; H. S. Beckman, president of the Seaside National Bank, Long Beach, Calif., treasurer; E. Schwartz, as secretary, and H. E. Curtis and J. H. Betts, as vice-presidents.

## Rubber Output Increases

NEW YORK, June 22—Production of crude rubber on Malayan estates of over 100 acres increased during May to 18,904 tons, as compared with 17,039 tons in April. Production on the smaller estates, mostly native, also increased to 15,399 tons, from 11,925 for the previous month.

## Business in Brief

### Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

NEW YORK, June 24—Retail trade again declined to some extent last week, although there was a slight improvement in wholesale and jobbing lines. Retailers' stocks have become considerably depleted, and they are beginning to place orders with wholesalers somewhat more freely. Reports indicate that tourist travel in this country has not been up to the level of former years.

**CHAIN STORE SALES**

Sales of 49 store chains during May totaled $290,766,180, as against $300,118,772 a year ago. Sales of three mail-order houses during May amounted to $51,576,823, as against $58,708,367 a year ago.

**CAR LOADINGS**

Railway freight loadings during the week ended June 6 totaled 760,890 cars, which marks an increase of 49,956 cars above those during the preceding week, but a decrease of 174,692 cars below those a year ago, and a decrease of 294,878 cars below those two years ago.

**COTTON CONSUMPTION**

Cotton consumed during May amounted to 532,719 bales, including linters, as against 575,551 bales during the preceding month and 540,485 bales a year ago.

**CRUDE OIL OUTPUT**

Average daily crude oil production for the week ended June 13 amounted to 2,463,100 bbl., as against 2,474,950 bbl. for the preceding week, and 2,571,500 bbl. a year ago.

**FISHER'S INDEX**

Professor Fisher's index of wholesale commodity prices for the week ended June 20 stood at 70.0 as against 69.7 the week before, and 70.0 two weeks before.

**BANK DEBITS**

Bank debits to individual accounts outside of New York City during the week ended June 17 were 25 per cent below those a year ago.

**STOCK MARKET**

After the sharp advances in the two weeks preceding, the stock market during most of last week was decidedly reactionary. The volume of trading was at a low level, and on Wednesday fell below 1,000,000 shares for the first time for any full five-hour day in almost five years. The railway issues were particularly weak, despite the petition of the railroads to the Interstate Commerce Commission for an advance in freight rates. Sharp advances in most issues took place on Saturday with the announcement by President Hoover in favor of a postponement of allied debt payments and reparations.

**BROKERS' LOANS**

Brokers' loans in New York City during the week ended June 17 decreased $71,000,000. This decrease follows a total decline of $359,000,000 during the eight preceding weeks.

**RESERVE STATEMENT**

The consolidated statement of the Federal Reserve banks for the week ended June 17 showed a decrease of $20,000,000 in holdings of bills bought in the open market. Holdings of government securities and discounted bills remained unchanged. The reserve ratio on June 17 was 85.2 per cent, as against 84.4 per cent a week earlier, and 84.2 per cent two weeks earlier.

## Hudson Adds 763 Dealers

DETROIT, June 22—The Hudson Motor Car Co. has added 763 new Hudson and Essex dealers to date this year, according to William J. McAneeny, president and general manager.

# Plymouth Names Moock for Sales

## Staff is Increased With 30 District Sales Promotion Men

DETROIT, June 27—Announcement of the appointment of H. G. Moock as general sales manager, Plymouth Motor Corp., and the appointment of directors of Plymouth sales for Chrysler Sales Corp., Dodge Brothers Corp. and De Soto Motor Corp. (divisions of Chrysler Corp.), has been made by F. L. Rockelman, president. This completes the executive staff of the Plymouth plant.

The appointment of Mr. Moock has been rumored throughout the industry for several weeks, as he has been functioning in this new position for some time. Mr. Moock has been connected with Chrysler Corp. in various sales capacities. Prior to his connection with Chrysler he was secretary-manager of the National Automobile Dealers Association.

S. W. Munroe, J. W. Hutchins and J. F. Boyd, according to the announcement, are named directors of Plymouth sales for Chrysler Sales Corp., Dodge Bros. Corp. and De Soto Motor Corp., respectively.

Announcements made during the past few months establish the Plymouth executive staff as including, in addition to Mr. Rockelman, president, and Mr. Moock, general sales manager—P. C. Sauerbrey, vice-president and operating manager; N. F. Hadley, chief engineer; K. G. Pound, director of distribution; J. B. Wagstaff, director of advertising and sales promotion, and H. E. Heath, service.

In addition to the executives named, Mr. Rockelman announced the appointment of more than 30 Plymouth sales promotion representatives.

The sales promotion representatives and the districts to which they have been assigned are: V. D. Benedict, Pittsburgh; LeRoy Bunn, Chicago; H. R. Bish, Washington; J. E. Chadwick, Des Moines; J. D. Costlow, Philadelphia; A. A. Crumley, Detroit; R. G. Donohue, Omaha; W. H. DeLancey, Kansas City; R. M. Depew, Peoria; M. V. Dunavant, Charlotte; E. S. Egge, Nashville; J. H. Hoag, Newark; Jack Huge, Buffalo; R. W. Ingersoll, Memphis; Frank Lacey, Oklahoma City; J. R. Lakin, New York City; H. R. Lasley, Dallas; E. H. Osborne, Atlanta; R. C. Ripley, Milwaukee; C. A. Robertson, San Antonio; Ray Simons, Columbus; H. B. Smith, Portland; W. H. Smith, Indianapolis; E. F. Steffen, Los Angeles; W. L. Stockinger, San Francisco; R. H. Strain, St. Louis; B. W. Travis, Denver; H. E. Westerdale, Boston; R. E. Wettergren, Minneapolis; H. C. Wilson, St. Louis territory; E. J. Wright, Syracuse, and A. H. Larson and A. L. Millard attached to the home office.

# + + CALENDAR + + OF COMING EVENTS

**SHOWS**

International Garage Exposition, Berlin, Germany .....May 9-Aug. 9

**CONVENTIONS**

National Association of Credit Men, Boston, Mass. .....June 22-27

American Society Mechanical Engineers, Madison, Wis. (Oil and Gas Power Meeting).....June 23-26

National Association of Taxicab Owners, Chicago, Ill. .....June 29-30

S.A.E. Aeronautic Meeting (in conjunction with Natl. Air Races), Cleveland, Ohio .....Sept. 1-3

Eastern States Exposition, Springfield, Mass. .....Sept. 20-26

American Welding Society, Boston, Mass. .....Sept. 21-25

American Electric Railway Assn., Atlantic City, N. J.....Sept. 26-Oct. 2

S.A.E. National Production Meeting, Detroit .....Oct. 7-8

National Safety Council, Chicago, Ill. .....Oct. 12-16

Society Industrial Engineers, Pittsburgh, Pa. .....Oct. 14-16

Transportation Meeting, S.A.E., Washington, D. C. .....Nov. 10-12

## Ford Adds Convertible

DETROIT, June 22—A new convertible sedan has just been announced by the Ford Motor Co. The new body type, with its slanting windshield, is in the Ford de luxe group. It accommodates five persons.

The top folds flat and may be inclosed in a boot. The upper structure is rigid, eliminating the possibility of vibration noise. The top is of tan rubberized material. Garnish moldings are in walnut finish.

The door windows and quarter windows may be raised and lowered with regulators. The driver's seat is adjustable. The front passenger seat folds down to permit entrance to the rear. The seat cushions are finished in dark tan genuine leather.

## Racing Bodies Agree

WASHINGTON, June 22—The Contest Board of the American Automobile Association and the International Motor Contest Association have reached an agreement under the terms of which racing drivers licensed by either body will be considered eligible for license by the other. For the present, promoters and track owners affiliated with either body will have their activities confined to that body, and each organization has agreed to respect the independent identity and activity of the other. Cars registered with the I.M.C.A. will be given until the end of the year to remove superchargers, which are permitted under the contest rules of that body.

# Ford Lists Amount Spent Near Detroit

## In 1930 the Sum Was $374,000,000, Recent Report Shows

DETROIT, June 22—The Ford Motor Co. in 1930 spent approximately $374,000,000 in the Detroit metropolitan area, according to a compilation completed recently. Of this, nearly $210,000,000 was spent for material, supplies, construction and miscellaneous services purchased from more than 450 Detroit firms. And in addition to $159,000,000 paid in salaries and wages to employees who in turn spent most of their earnings in the Detroit trading area, the company paid more than $5,000,000 in taxes and special assessment levies.

The company also paid out, largely in the Detroit area, more than $1,500,000 in returns upon approximately $19,000,000 which Ford employees have deposited, as savings from wages or salaries, in the Ford investment fund.

Added to the $374,000,000 expended by Ford Motor are millions spent by Henry Ford in the development of his Greenfield Village, Edison Institute of Technology, Henry Ford Hospital, new Dearborn Inn and other personal or philanthropic projects.

On the basis of a five-day operating week, Ford Motor Co. in 1930 spent nearly $1,500,000 a day in Detroit alone.

Among the Detroit concerns whose Ford orders ranged from one to several millions of dollars were the following: Ainsworth Mfg. Corp., windshield frames; American Brass Co., brass products; Bower Roller Bearing Co., bearings; Briggs Mfg. Co., bodies; Budd Wheel Co., wheels and body parts; Detroit Gear & Machine Co., steel castings; Essex Wire Co., wire products; General Spring & Bumper Co., truck bumpers; Kelsey Hayes Co., wheels; Long Mfg. Co., radiator cores; Michigan Steel Corp., steel; Motor Products Co., molding strips; Murray Corp., bodies; Timken-Detroit Axle Co., axles; United States Rubber Co., tires, and L. A. Young Spring & Wire Co., springs.

Pistons were supplied by Bohn Aluminum & Brass Corp.; carburetors by Holley Carburetor Co. and Zenith Detroit Corp.; gaskets by Detroit Gasket & Mfg. Co. and McCord Radiator Co.; valves by Wilcox-Rich Corp. and Scott Valve Mfg. Co., and clutches and crankshafts by Continental Motors Corp.

**National Standard Company** earnings for the eight months ended May 31 showed an increase of 19 per cent as compared with the same period of 1930. Net income for the period ended last month was $425,811, equivalent to $2.90 a share on the 146,536 shares of capital stock outstanding. For the eight months ended May 30, 1930, net income was $356,979 or $2.43 a share on the same capitalization.

## Hails Rear-Engine Streamline Car

*(Continued from page 991)*

automobile accidents are the result of personal factors and are not attributable to the car itself.

W. S. James, research engineer, Studebaker Corp., stressed the need for the driver paying strict attention to his job and being prepared by deciding in advance, so far as possible, what course he will take in the event that an emergency arises. He advised gripping the steering gear tightly in any event.

### Comparisons of Road Resistances for Conventional and Tear-Drop Designs

(Based on known constants and equations and comparative wind tunnel results)

| Speed in M.P.H. | Total Road Resistance Conventional Sedan (lb.) | Tear-Drop Sedan (lb.) | Ratio Conventional Sedan to Tear-Drop Sedan |
|---|---|---|---|
| 90 | 425 | 182 | 2.3 to 1 |
| 80 | 342 | 150 | 2.3 to 1 |
| 70 | 270 | 127 | 2.1 to 1 |
| 60 | 208 | 103 | 2.0 to 1 |
| 50 | 155 | 81 | 1.9 to 1 |
| 40 | 112 | 65 | 1.7 to 1 |

Fred S. Duesenberg spoke of the importance of freedom from side-sway and of good pick-up in tending to make high-speed driving safer. Good brakes, he added, are of great importance and they should not be applied too severely. There is no substitute for care and good judgment, however, in seeking to avoid accidents.

The writer mentioned the fact that a considerable proportion of accidents result from driving on the wrong side of the road. He advocated following the general rule of not driving so fast that a stop cannot be made within the distance one can see that the road is clear ahead.

---

## Reduced Chassis Flexibility Obviates Excessive Body Weight

*(Continued from page 989)*

daille-Hershey Corp., expressed himself as of the opinion that heavier frames were needed. And that this realization had come about five years too late.

L. Clayton Hill, president, Dietrich, Inc., said too little was known regarding the fundamentals of frame design. He felt that much of the present trouble was due to the widening of treads, lengthening of wheelbase and introduction of double-drop frame constructions. All of these, he said, tended to weaken a frame and insufficient strength had been added to offset these effects.

W. S. James, research engineer, Studebaker Corp., presented some interesting figures, showing the wide divergence in the relative contribution of frames and

**Swimmers in the Ranks of the S.A.E.**

Seated, left to right—Mrs. Murray Fahnestock, C. S. Bruce, Mrs. and Mr. Ernst J. Hergenroether. Standing—E. S. Smith, A. Hoertker, W. F. Rockwell, Gordon Brown (water carnival champ), W. J. Leaden and C. M. Dawe, "Carnivalissimo"

bodies to total car torsional rigidity. Some of these figures follow:

| Car No. | Frame | Frame and Engine | Frame, Engine and Body |
|---|---|---|---|
| 1 | 41 | 204 | 850 |
| 2 | 122 | 136 | 715 |
| 3 | 92 | 109 | 453 |
| 4 | 108 | 195 | 760 |

These figures were used by Mr. James in illustrating his argument that frame rigidity had but little to do with final car torsional rigidity.

In his paper on Body Comfort and Interior Appointments, Mr. Brunn said that comfort was the primary consideration and that style, while important, should be built around a seating arrangement, rather than vice versa. He advocated hard, rather than soft seats for comfort on long drives, and pointed out the necessity of an adequate support for the small of the back.

Regarding body insulation, Mr. Brunn said that in his experience wood framework with aluminum panels and leather top and side quarters is less susceptible to the noises that arise from the chassis than the all-steel or virtually all-steel design. For ventilation he suggested combination dome lights and ventilators in the roof and also small glass panels 3 or 4 in. wide on the outside of the upper part of the door frames.

Mr. Brunn felt that vanity cases are fast disappearing from use as standard equipment as they really are not needed, in his opinion. They are being replaced, he said, by ash trays and cigar lighters in the arm rest. Ground glass mirrors are also good accessories, he felt. Mr. Brunn advocated the use of English Neutralite glass for outside visors.

In discussing this paper, Herbert Chase, consulting engineer, New York, said that there was a need not only for horizontally but also for vertically adjustable seats—especially for the driver, to take care of people of shorter stature. He suggested the use of an inclined track so that the seat would be raised at the same time it is brought forward. He also suggested the use of independent springing for increased comfort at the rear since it would make possible the elimination of the so-called "dish-pan" under the rear seat cushion for differential clearance.

# THE TIME HAS COME

FOR years Air Cleaner Specifications have been tossed from desk to desk. Air Cleaners were bought on price. Today Air Cleaners are investigated, tested and the correct Air Cleaner for the particular installation is assured. Price is still a rightful factor but is not the deciding feature. The Absolute Air Cleaner, because of its double action of centrifugal force and screen filter, provides low restriction and equal performance under all weather conditions with unusually low service requirements. The time has come to ask our engineers the correct type for installation on your power plant. No obligation involved.

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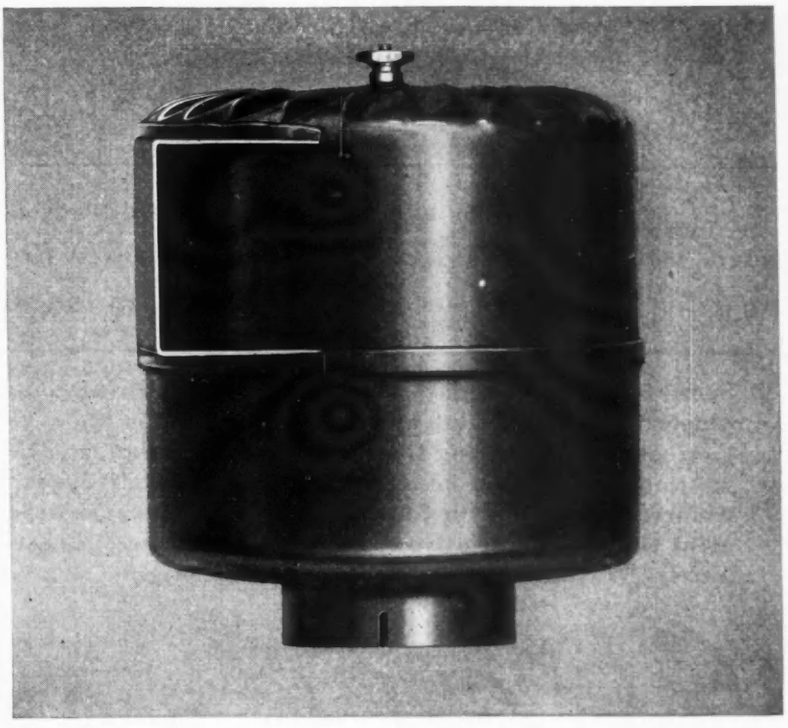

The Absolute Air Cleaner—an exclusive, patented United product

Well known car, tractor and truck companies are using United Air Cleaners as standard equipment . . . . . .

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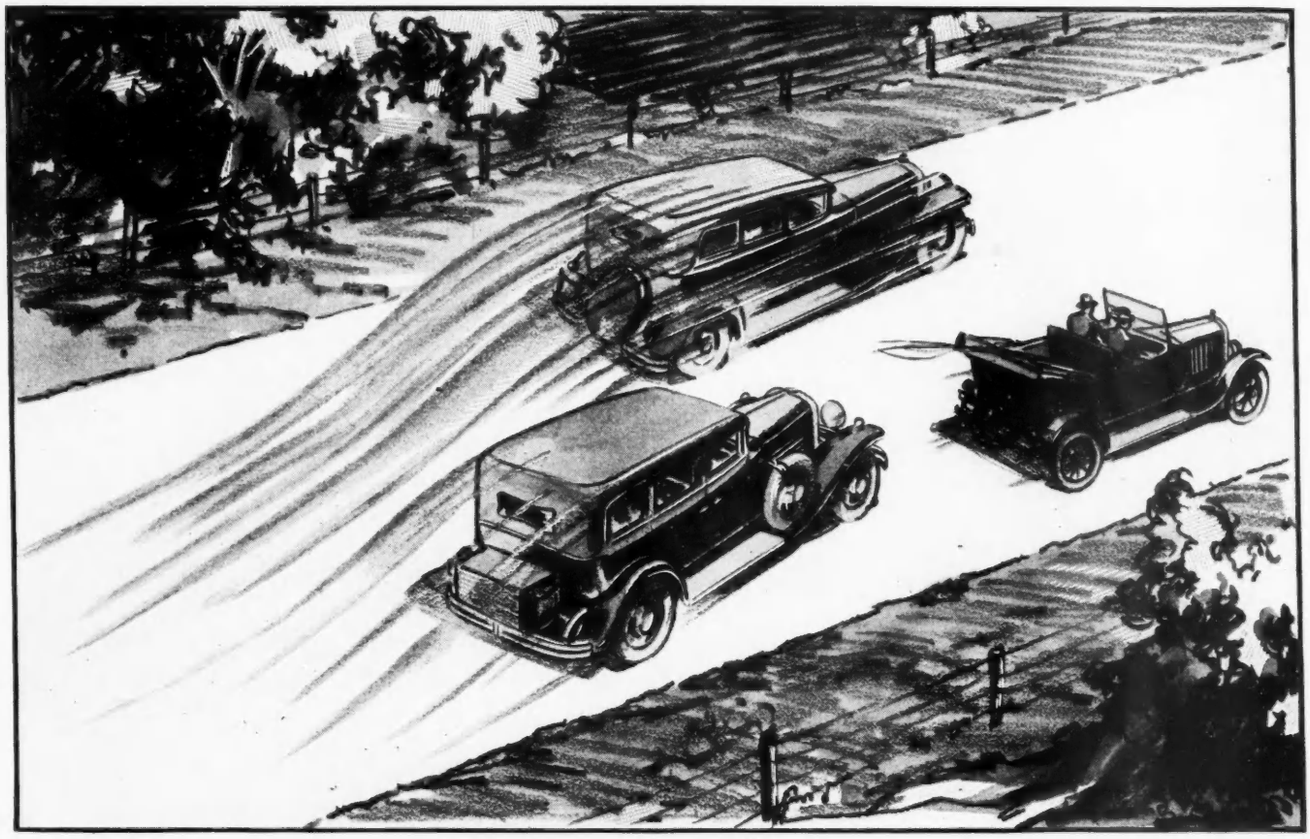
UNITED AIR CLEANER

# Steering Keyed to Today's Speeds Must Respond "*Right Now*"



● *Safety—mental ease—physical relaxation—at today's high speeds—all demand steering that responds accurately and instantly. Ross inspires the driver with well-founded confidence in his control in any situation where safety depends on steering*

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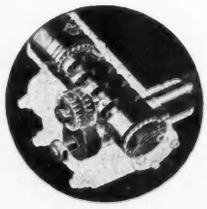
**Speed is built into today's cars—to stay. For driving comfort and safety, steering must be proportionately accurate and responsive—*for the life of the car*. The Ross Roller-Mounted Cam and Lever Steering Gear is the most accurate and instantly responsive instrument of steering that has ever been put in a driver's hands. It maintains this accuracy and responsiveness throughout the life of the car—*first*, because wear has been reduced to a negligible point through the relative absence of friction; *second*, because precision adjustments built into the gear make it possible to retain the original accuracy of alignments and clearances.**

ROSS *Cam and Lever* STEERING
ROLLER MOUNTED

ROSS GEAR & TOOL CO.
LAFAYETTE, INDIANA



# COMPLETE RESPONSIBILITY

## From Good Blanks to the Highest Degree of Commercial Accuracy In Finished Gears

***The "Fellows" Method of Gear Production includes equipment for gear cutting under precision control and automatic inspection of the finished product.***

YOU have one primary concern—to produce acceptable gears at the lowest cost per gear OK-ed for assembly. It is manifestly to your advantage to have responsibility focused in one place—on one equipment manufacturer. It means the immediate rectification of trouble—as against the time loss of sifting out who's responsible as between several possibilities. * * * That is a very real advantage, for lost production can quickly run up a total in dollars which makes divided responsibility anything but economy. There is an ultimate saving in standardizing not only on Fellows Gear Shapers, but "Original Fellows" Gear Shaper Cutters and Fellows "Red Liner" inspection as well. Argue it out in dollars and cents with a Fellows Sales Engineer. Make him prove it in terms of your own product.

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SPRINGFIELD, VERMONT, U. S. A.
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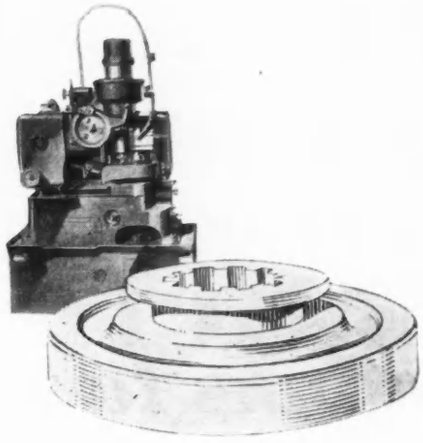
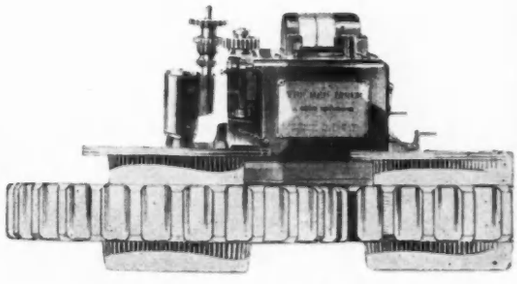
~ GEAR SHAPERS ~



FELLOWS METHOD

FELLOWS CONTROL



FELLOWS INSPECTION

# SHAKEPROOF

## Greater Locking Power — thanks to the Patented Twisted Teeth!

This shows the position of each tooth when the nut is first tightened down. Note the powerful leverage that is automatically set up against any movement of the nut.

When vibration tends to loosen the nut, the spring action of the twisted tooth acts instantly and the sharp edges are forced deeper into both the work and the nut. This action is only possible with Shakeproof's patented twisted teeth.

As vibration becomes more intense, the teeth bite in still deeper—always exerting that powerful leverage against any movement of the nut. At the same time, the spring action of the tooth keeps the threads of the nut tight against the threads of the bolt—thus creating a friction that makes the lock absolutely secure.

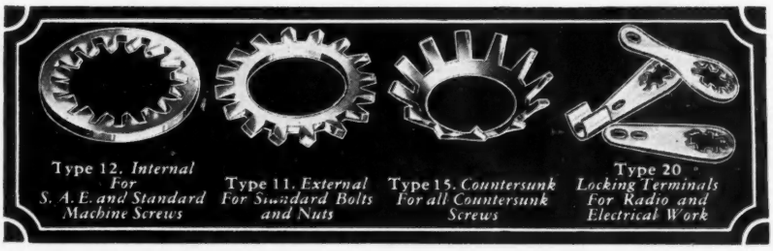
WHEN a nut or screw is turned down on a Shakeproof Lock Washer, it can't work loose. The patented twisted teeth prevent any movement and as vibration increases the teeth bite in deeper—thus, assuring absolutely tight connections.

This practical locking method has proved its superiority on thousands of products in hundreds of industries. Shakeproof Lock Washers are adding years of extra performance to Automobiles—Radios—Electrical Appliances—Stoves—etc. In fact, practically every leading manufacturer today is using Shakeproof to protect his product from the damaging action of vibration.

Be sure to test this powerful locking method in your own shop. See for yourself how it improves performance and reduces customer complaints. Free samples will be gladly sent on request—mail the coupon, today!

U. S. Patents:
1,419,564
1,604,122
1,697,954
1,782,387
Other patents pending.
Foreign patents.

**SHAKEPROOF**
***Lock Washer Company***
*{Division of Illinois Tool Works}*
2505 N. Keeler Avenue, Chicago, Ill.


Type 12. Internal For S. A. E. and Standard Machine Screws
Type 11. External For Standard Bolts and Nuts
Type 15. Countersunk For all Countersunk Screws
Type 20 Locking Terminals For Radio and Electrical Work

*Shakeproof representatives are located in the following cities*

New York City Philadelphia Boston Pittsburgh Schenectady Cleveland
Detroit Toledo Cincinnati Birmingham, Ala. Dallas, Texas Milwaukee
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## COUPON

Gentlemen: We want to test your Shakeproof Lock Washers. Kindly send us samples as indicated.

Type..... Size.....
Type..... Size.....

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# C D F Protection

## insures permanent, accurate, silent timing

Today, motors must maintain top performance after the first ten or twenty thousand miles of service.

# CELORON
## SILENT TIMING GEARS

Motor performance depends too much upon accurate, silent timing to permit any compromise in the timing drive. That's why a majority of automobile motors made today are Celoron Gear Timed. C. D. F. protection through Celoron Silent Timing Gears is protection against poor motor performance—before and after the first 20,000 miles, is protection for your customer's good will, and is protection against losing repeat sales.

The perfection of Celoron Silent Timing Gears during the last few years, make them worthy of your serious consideration for your present motors, and for new motors you may be designing. C. D. F. engineers will be glad to work with you in designing Celoron Timing Gears for your motors.

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*Manufacturers of Dilecto—Diamond Fibre—Celoron—Micabond*

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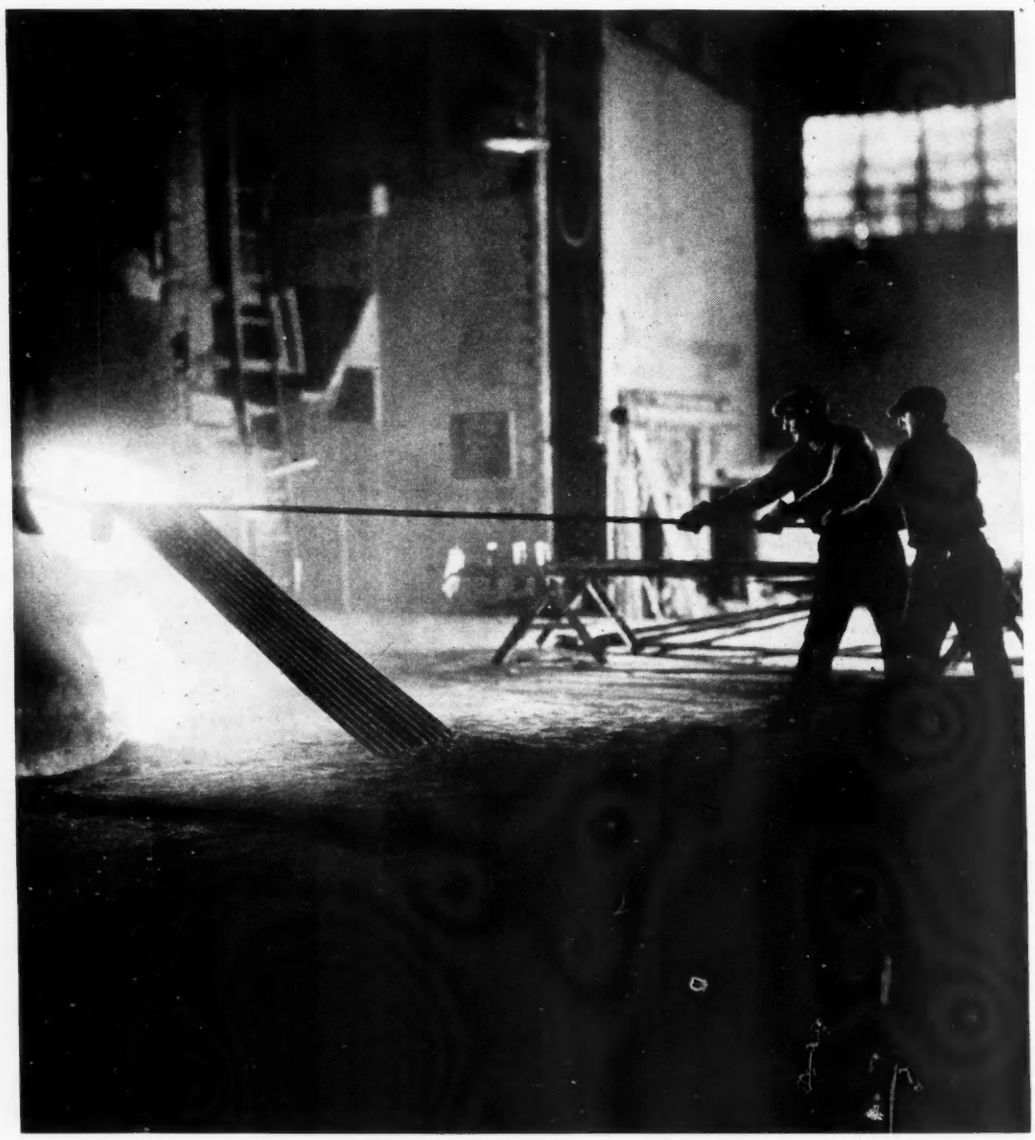


# BACK OF EVERY HEAT

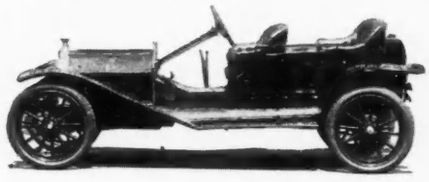
Ability to control the production of Illinois Alloy Steels assures users of uniformity. Such control includes careful selection of producing facilities, reliable laboratory methods, and skilled supervision of each step in the production processes.

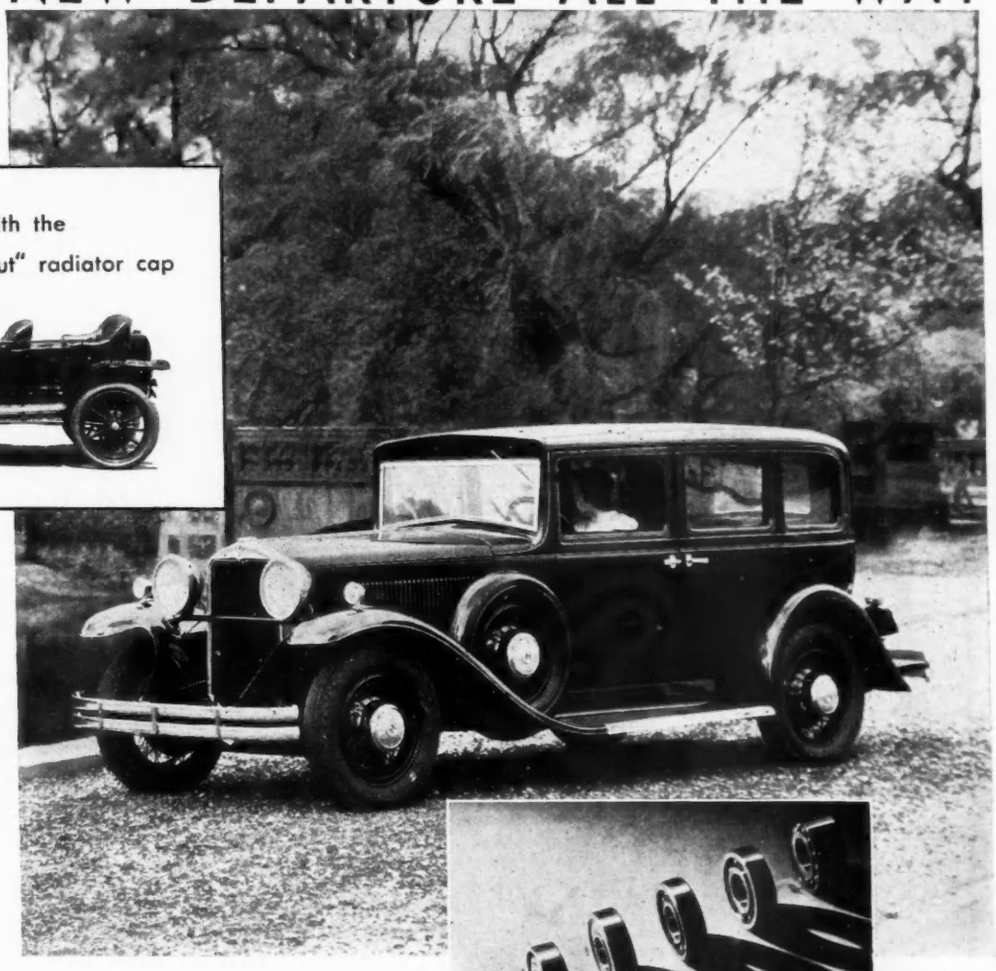
**Illinois Steel Company**
SUBSIDIARY OF UNITED STATES STEEL CORPORATION
208 South La Salle Street, Chicago, Ill.

**ILLINOIS *alloy* STEEL**

# NEW DEPARTURE ALL THE WAY

The 1909 Hupmobile with the famous "waterspout" radiator cap





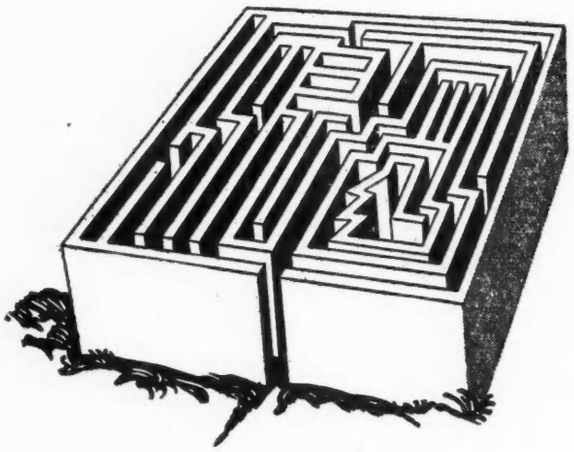
## HUPMOBILE

**is a name that has stood for fine car making for 23 years. There is no better proof of the excellence of New Departure Ball Bearings than the fact that they have been a part of every Hupmobile ever made, including the old Model 20 — the first car to make a complete trip around the world. New Departures have kept pace with the progress of the industry and stand today unsurpassed as a product of mechanical excellence—durable, precision, high-duty, anti-friction bearings. Nothing rolls like a ball. The New Departure Mfg. Co., Bristol, Conn.; Detroit, Chicago, San Francisco.**

## NEW DEPARTURE BALL BEARINGS

TRUE STORIES OF BUSINESS SUCCESSES IN NEW ENGLAND.

# HIS WAY OUT OF A BEWILDERING SALES MAZE



## SALES INCREASED MORE THAN 50%

A few years ago a certain Massachusetts manufacturer's sales graph began to wave up and down. Its prevailing trend was steadily down.

The company faced handicaps common to many corporations. Its capital was limited. It had no sales force—no consumer recognition. Its machinery could make but one kind of product.

How could the business be built up?

Experts experimented. First they tried one idea, then another. At last they discovered a new product that could be made without changing any of the machinery. Samples were sent to a selected list of friends. On the strength of their favorable comments it was decided to market the novelty.

A preliminary survey was made. Then each of these four marketing plans was tested for three months—

1. Sideline salesmen carried the novelty as one of their numerous items.

2. The merchandise was distributed through jobbers and sales agents, the company relying upon their efforts to sell the goods.

These two plans proved impractical. With a consumer price of 75¢, the article was so small that it was lost in the long line of salesmen's and jobbers' larger items.

3. Magazine advertising was used to sell to consumers direct.

This method proved widespread consumer interest, but it brought little profit.

4. Sales were made to retail stores throughout the country by advertising in trade journals and direct mail.

This last plan held the solution. The first announcement opened 99 new accounts.

In two years the company has secured distribution in 90% of the country's key department stores, and has ironed out its sales graph. Sales move steadily upwards. In the first 6 months of 1930 they increased more than 50% over the same period in 1929.

*Are you missing this opportunity?*

Seeking means to help New England produce larger sales and larger profits is one of Shawmut's perpetual aims. Our 94 years of business experience—and our thousands of contacts throughout the six states, frequently enable the Shawmut Merchandising Division to make really helpful suggestions to both large and small businesses.

We make neither extensive investigations nor definite promises. But, when an executive faces a New England marketing problem it is quite possible that Shawmut may be able to make some really constructive suggestions.

Why not try us? The first step is to write to our Merchandising Division outlining your problems. Perhaps Shawmut can help.

THE NATIONAL

# Shawmut Bank

40 WATER STREET · BOSTON

This Advertisement Appeared in the New York Times
May 19, 1931

# HIS WAY OUT WAS NOT NEW —BUT TRIED *and* PROVED

The quickest exit from any maze is to follow someone who knows the way. There are people like that, if you know who to follow.

Some motor car manufacturers have discovered their leader in the Chilton Class Journal Company. Three notable examples are given below:

*In 1915,* this organization promoted a trade campaign for the manufacturer of a high priced car, which resulted in 4,000 bona fide trade inquiries, and an actual business of over $3,000,000 worth of automobiles, over a period of about 3 months. The cost was absurdly small compared with the results.

*One year later* a new medium priced car was put on the market, using almost exactly the same trade paper campaign. An excellent dealer organization was formed almost over night.

*In 1925* a high priced car, that had had a great many ups and downs, put on a smashing campaign in the business papers, with the result that the organization jumped from about 10 dealers in September to over 400 by the end of the following January. This particular campaign brought in over 3,000 inquiries.

In 1930 this was accomplished again, and, with this experience, the Chilton Class Journal Company stands ready to present a plan that, based on the rule of percentage, has never failed. We would appreciate an opportunity to discuss the matter with two or three of your executives who are interested in this work.

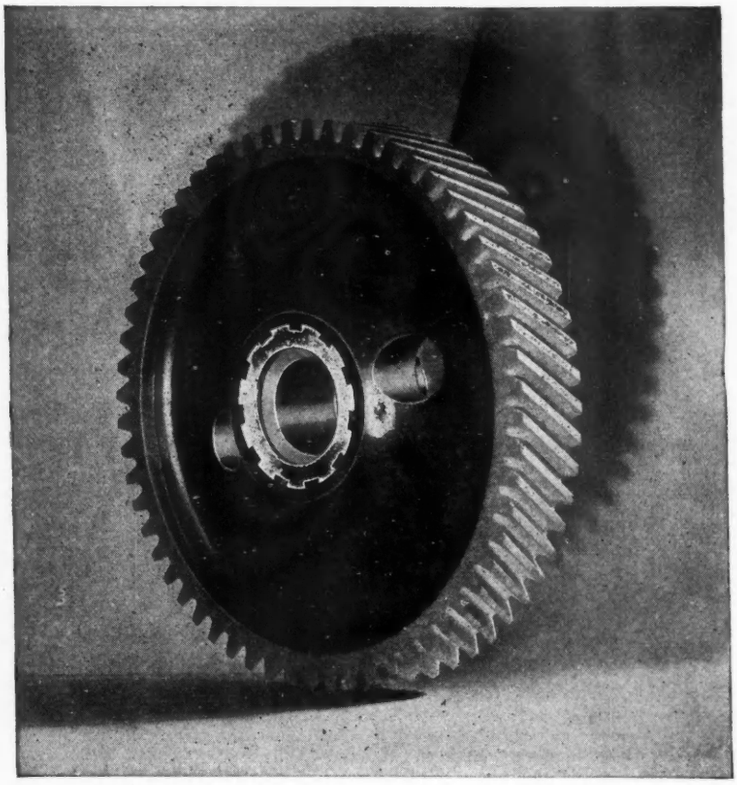
*Come to Automotive Headquarters!*

AUTOMOBILE
TRADE JOURNAL

A Chilton Class Journal Publication

Chestnut and 56th Sts. Philadelphia, Pa.

Controlled by the United Business Publishers, Inc.



# There Is Nothing To Adjust

ALL types of timing mechanisms except gears require adjusting from time to time to offset the effects of wear. But "adjusting" cannot reëstablish synchronization between crankshaft and camshaft—it merely takes up slack.

Timing gears, on the other hand, are good for 50,000 miles of service without any adjusting. In fact, there is nothing to adjust.

**TEXTOLITE TIMING GEARS**

The material from which modern camshaft gears are made has a specific gravity less than half that of aluminum. It is 40 times more elastic than steel. It is nonresonant, resilient, and vibration-absorbing.

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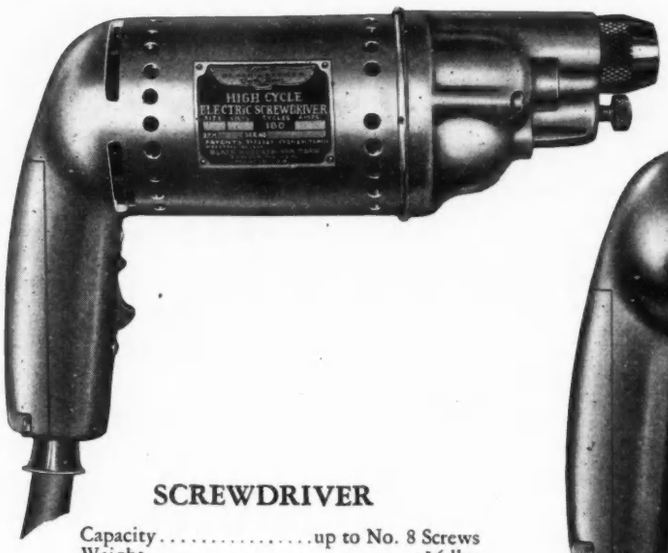
JOIN US IN THE GENERAL ELECTRIC PROGRAM, BROADCAST EVERY SATURDAY EVENING ON A NATION-WIDE N.B.C. NETWORK

GENERAL ELECTRIC

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

# *The* NEW HIGH CYCLE TWINS for Fast Automobile Trim Work




**SCREWDRIVER**

Capacity.....up to No. 8 Screws
Weight.....4½ lbs.
No Load Speed.....500 R. P. M.

**3/16-INCH DRILL**

Capacity in Steel .....3/16"
Weight.....4 lbs.
No Load Speed.....2,800 R. P. M.

SMALL in size, light in weight, powerful in operation, the new Black & Decker-Van Dorn High Cycle Twins are designed to do their work with great ease and speed, even in close quarters. Small body diameters and rounded exterior surfaces fit the tools to the hand and afford the operators easy grasp in any position. With them your operators can do more work, in less time, at less cost.

The High Cycle Screwdriver has an adjustable friction clutch which drives the screw "flush" and releases immediately without danger of marring the screwhead or surrounding surface. Driving tension can be conveniently set with the knurled thumb screw on the gear case. When necessary, the bit can be given an extra turn by a mere pressure of the finger on the clutch control. In addition, this screwdriver has a positive clutch which allows the spindle to remain idle for finding slot in screw, and immediately engages the bit when pressure is exerted. This new unit is ideal for the many light screwdriving applications in automobile assembly and trim work.

The drill is fitted with a 3/16" key-operated chuck and a 4-conductor cable without plug. Like its companion, the screwdriver, it has all the features found in the other tools of the High Cycle line including the new squirrel-cage type motor, with welded copper bar rotor, operating on 180 cycle current. This drill is particularly applicable to the requirements of the automotive industry.

***If you are using ten or more Portable Electric Tools, let one of our Sales Engineers show you how readily an installation of High Cycle Tools may be made in your plant, and why they will produce more work in a given time than universal motored tools. Or mail the coupon below for our catalogue describing the complete Black & Decker-Van Dorn High Cycle line.***

## BLACK & DECKER-VAN DORN SUPER PRODUCTION TOOLS

*The* BLACK & DECKER MFG. CO.
*The* VAN DORN ELECTRIC TOOL CO.

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BLACK & DECKER - VAN DORN
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Please send me your newly published catalogue describing the complete line of Black & Decker-Van Dorn High Cycle Tools.

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# A Seamless Steel Tubing IDEAL *for* A THOUSAND USES

IN industry and transportation, wherever lightness, strength, safety and economy of construction are desirable, designers are specifying seamless steel tubing. Particularly, many designers are specifying "Pittsburgh" Seamless because of its accepted high quality and proved performance.

It is impossible to enumerate the number of purposes which Pittsburgh Seamless serves. In refineries, power plants, oil wells, refrigerating plants and numerous other industries where pressures, temperatures and corrosion are problems, it has served with distinction for years. In automobiles, trucks, locomotives, airplanes and ships, it has increased strength and eliminated excess weight. In stationary machinery it has increased safety and efficiency and effected many economies.

Undoubtedly Pittsburgh Seamless can serve you as efficiently and economically as it is serving countless others. It is furnished in special shapes and in most of the S. A. E. series of steel alloys. May we discuss your requirements?

**PITTSBURGH STEEL PRODUCTS CO.**

Pittsburgh New York Detroit Chicago St. Louis Tulsa Houston

DIVISION OF Pittsburgh Steel Co.

**Pittsburgh Seamless STEEL TUBING**

# STEWART WARNER

**TRAFFIC TESTED PRODUCTS**

Speedometers
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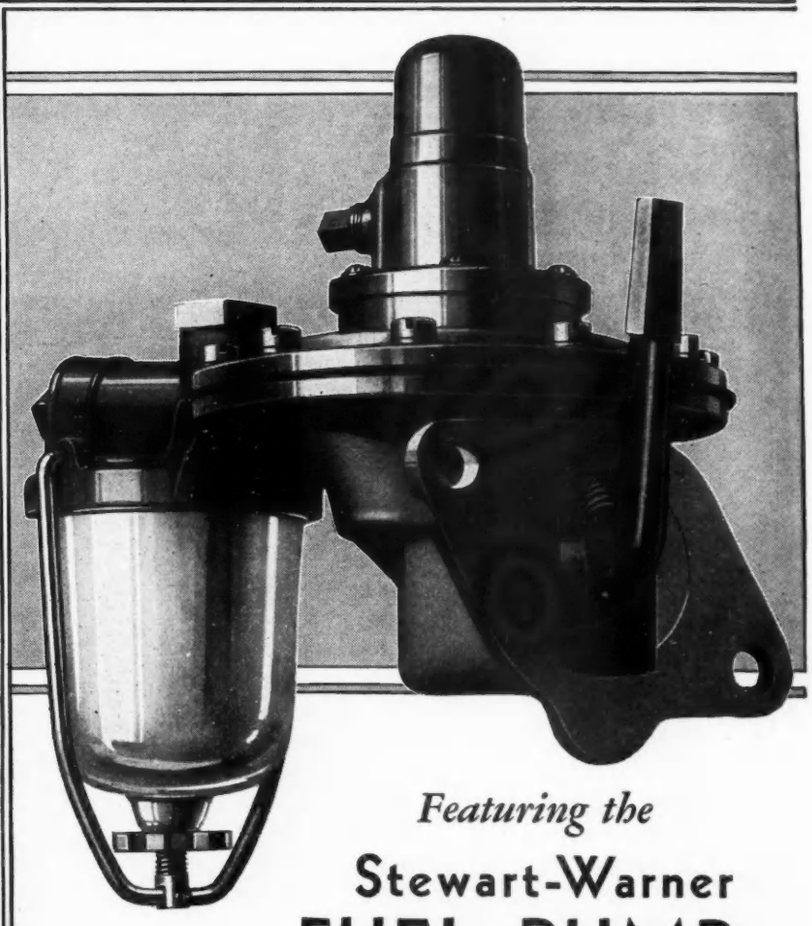


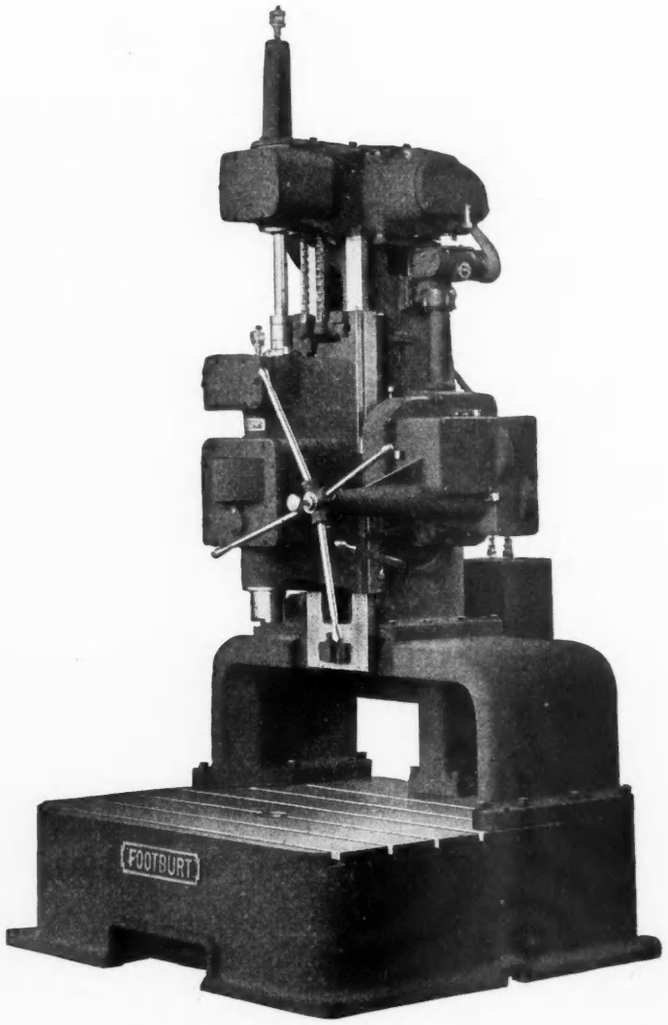
*Featuring the*

## Stewart-Warner FUEL PUMP

*"The Pump with the Compensating Diaphragm"*

When motordom's engineering aristocracy say — as they *do* — that this is the "best fuel pump ever built" — *that's something!* But when an increasing number of fine car makers adopt it as standard — as they're *doing* — *that's something MORE!* Put one on your test block — see for yourself why this pump will answer more satisfactorily *your* fuel feed requirements. Our engineers are at your command. Stewart-Warner Corporation, Chicago, Ill.

*Built by the Largest Manufacturer of Automobile Accessories in the World*




FOOTBURT

# Have you a boring problem?

This machine has answered in an economical way, the problem of boring hubs of agricultural implement wheels. Sizes run up to 3″ bore 10″ long with 4″ counterbore 1″ deep. It is just one of many special applications of our No. 15½ line.

May we figure with you on your drilling, boring, reaming and tapping problems? Just write.

## The Foote-Burt Company

Cleveland, Ohio

Detroit Office, 4-151 General Motors Building

## PIONEERS IN BETTER DRILLING METHODS

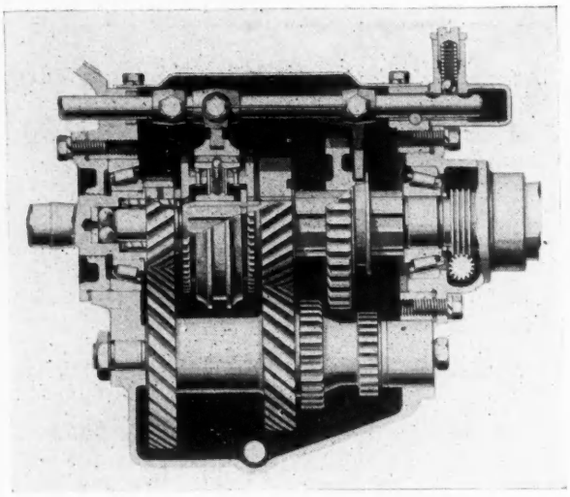
# It's a stainless steel wire wheel in everything but cost

The stainless steel wire wheel has been one of the paradoxes of motordom. Because of its dazzling good looks, it has been a definite sales help. But because of its necessarily high extra cost, it has been an undeniable sales obstacle. ☆ ☆ ☆ To-day all that is changed. For Budd has developed a stainless steel jacket that fits over a low-carbon steel spoke, and makes possible a wire wheel that is stainless steel in everything except cost! ☆ ☆ ☆ The base of each spoke is high quality low-carbon steel. Over that base is fitted the stainless jacket, 10/1000 of an inch thick. Once that jacket is put on, it's on to stay. It protects the spokes against rust. And neither rain, nor snow, nor sleet, nor strong-armed washers, nor high-pressure hoses can ever separate it from its less glittering base.

# ★WHEELS BY BUDD★

# Nash Adopts Synchronizing Clutches

*(Continued from page 1001)*



**The synchro-shift mechanism permits shifting gears at all speeds without noise and quiets second speed travel + + + +**

This cooler (or, rather, temperature regulator) consists of a number of venturi tubes through which the oil passes and which are surrounded by the cooling water in the jacket.

New spark plugs have been adopted which are said to render ignition more immune from effects of variations in combustion chamber temperature.

Probably the most important chassis feature, aside from the adoption of the new transmission, is in the rubber insulation provided between running gear and frame. All spring eyes now have rubber bushings, while front springs are shackled at the front end to reduce or eliminate wheel fight. A treadle type accelerator pedal has been adopted, rubber covered and shaped to fit the foot.

To improve the insulation the body and door panels are sprayed with an asphaltum composition, effective in reducing drumming and also insulating the bodies further against heat and cold.

## L-Head Eight

A number of changes made on the six are also found on the L-head eight. These include the new rubber-bonded vibration damper, new spark plugs, improved shock absorbers, rubber spring shackling, front-end front-spring shackle and treadle-type accelerator pedal. In the bodies of the 870, felt is used in addition to the asphaltum material for insulating body and door panels.

The oil temperature regulator on this model is of the "radiator" type, a small radiator core being mounted externally of the engine in the intake line from the radiator, so that water from the radiator regulates the temperature of the oil on its way from the pump to the bearings.

A new Stromberg downdraft carburetor has been adopted on the 870. Combined with it is a combination air cleaner and intake silencer of AC manufacture. A new and quieter four-bladed fan has been adopted in the cooling system, and the exhaust pipe flange has been increased in size to prevent blowing out of the gasket.

## Nash Series 980

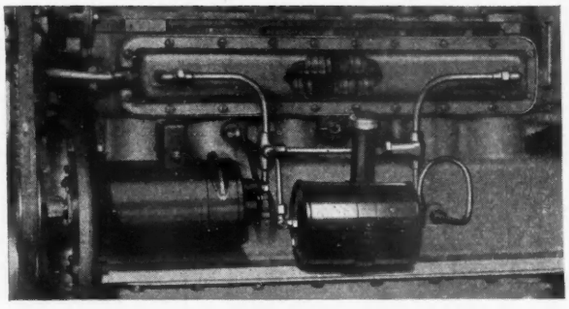
In the lower-priced twin-ignition eight are found the same type of oil regulator as on the 970, the new type vibration damper, air cleaner and intake silencer, etc. The power of the model has been increased from 85 to around 94 hp., it is claimed, through the adoption of a Stromberg downdraft dual carburetor. A manual control is provided on the dash for heat regulation to this carburetor and an engine primer has been worked out so that a shot of fuel will be injected by the pump only the first time the accelerator is depressed. This is intended to prevent overloading of the manifold with the use of the downdraft carburetor, and also increase economy of operation.

Graphite-loaded bushings are now used on this model for the valve stem guides, which receive oil from the engine lubricating system. Radiator capacity has been increased to 20 quarts, to correspond to the increased power in this model.

The exhaust pipe is wrapped with asbestos down to the motor pan and the muffler also is asbestos-wrapped, an outside shell of sheet metal tubing being provided over the asbestos covering.

Insulation in the bodies has been extended to body and door panels in a manner similar to the 870. Anti-squeak material is also being used to bind the edges of the toe-boards, while an asbestos millboard has been added below the toe-board for heat and noise insulation, as on the larger eight. The tool box under the front seat also is sprayed with asphaltum for the prevention of drumming.

*(Turn to page 1014, please)*



**The oil temperature regulator of the 960 series is constructed as part of the motor block side plate + + + + +**

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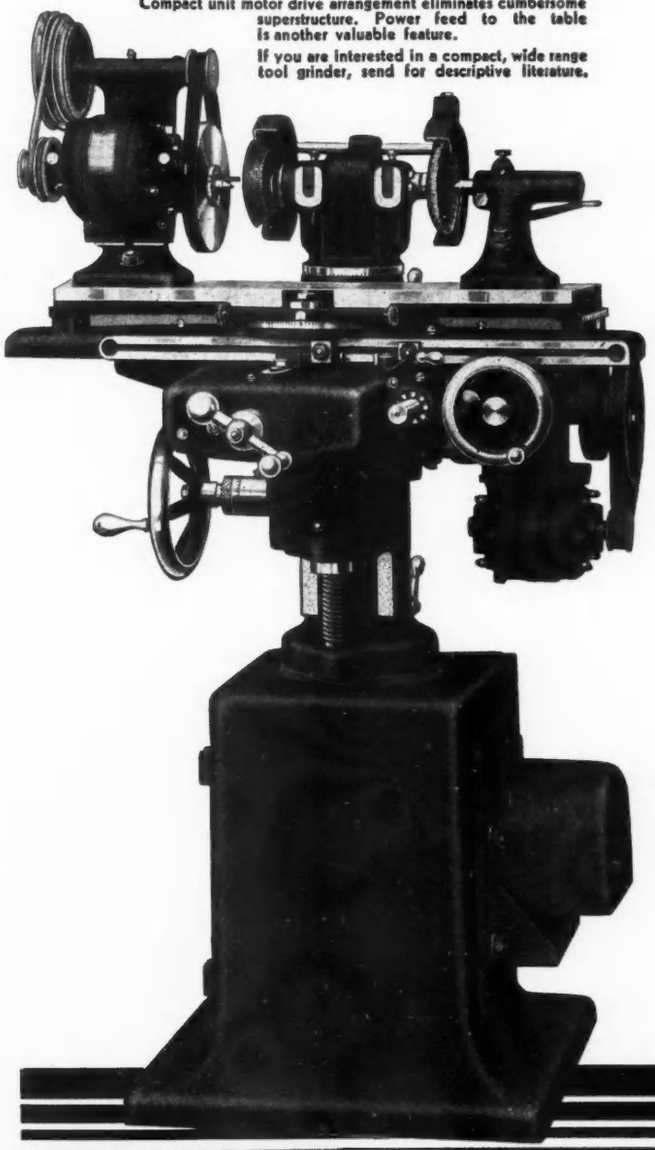

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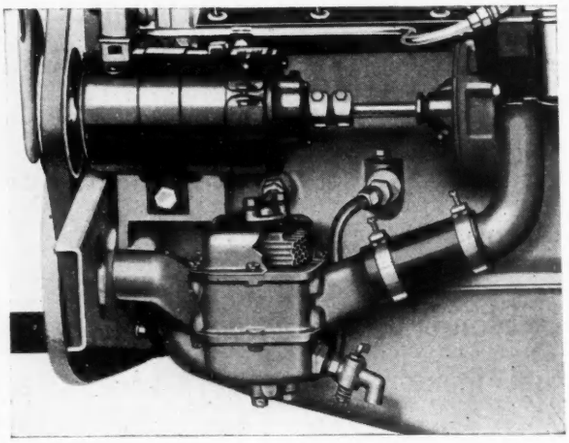
Brakes on this model have been increased in diameter from 12 to 13 in., resulting, it is stated, in a braking area of 232 sq. in. Deflection rates of chassis springs have been increased and larger capacity shock absorbers adopted for easier riding. On this model, as well as the larger twin-ignition eight, which carry Bijur automatic chassis lubrication, rubber bushings have been adopted at the rear of rear springs for silencing.



The oil temperature regulator in some of the new Nash models works in relation to the water cooling system + + + + +

A three-spoke steering wheel is now found on this model. The spark control has been located on the dash and a combination steering and ignition lock has been provided. Tire size has been increased on the 980 from 5.50 to 6.00 in. section on 18 in. wheels.

The cooling water circulation controlling thermostat is now located in the cylinder head.

## Nash 990

Many of the changes on the 980 also apply to the 990. These include improved shock absorbers, with rubber bushed links on the 990, new combination asphaltum and felt panel insulation, thermostat located in cylinder head outlet, rubber bushed rear of rear springs, and three-spoke steering wheel. A number of features, of course, just extended to the 980 and other models were to be found on the previous series of the larger twin-ignition eights.

In addition to the changes already mentioned, the braking system on the 990 has been extensively changed. Cable controls are now used to prevent rattles, etc.; levers have been rearranged for increased effectiveness and the drum size has been increased to 16 in. (2 in. lining being used). A steady rest has been added to the cross-shaft.

A one-piece flexible spring cover has been adopted in place of the laminated type formerly used, and a reflector has been added within the tail lamp to increase its visibility.

# Control of the Business Cycle

*(Continued from page 1002)*

which will authorize price control in the public interest, with the single basic restriction that "contract may run only to the establishment of the dealer's cost as the minimum of resale price." It follows then "as resale price centers around cost, differences in cost and margin requirements will form the basis of resale price differences."

In discussing the latter point Mr. Gaskill concludes that "the unlimited indulgence in the bare quantity discount has contributed more than any other cause to the confusion, derangement and disorder of distribution" and that therefore the bare quantity discount should be scrapped in favor of a contract which would classify customers of the manufacturer by the distribution function they serve, and allow them a price differential on this basis alone, without regard to quantity of merchandise involved, or any other factor. There is no reason or justification for limiting this procedure to branded merchandise, Mr. Gaskill believes.

Pointing out that the present "anti-trust laws are general descriptions rather than specific definitions, and that they do not state a rule which is capable of universal application, Mr. Gaskill says "it does not appear that the advance toward regulated competition lies in specific legislative prohibition" but "in the legislative declaration of a public policy founded on a new concept of public interest."

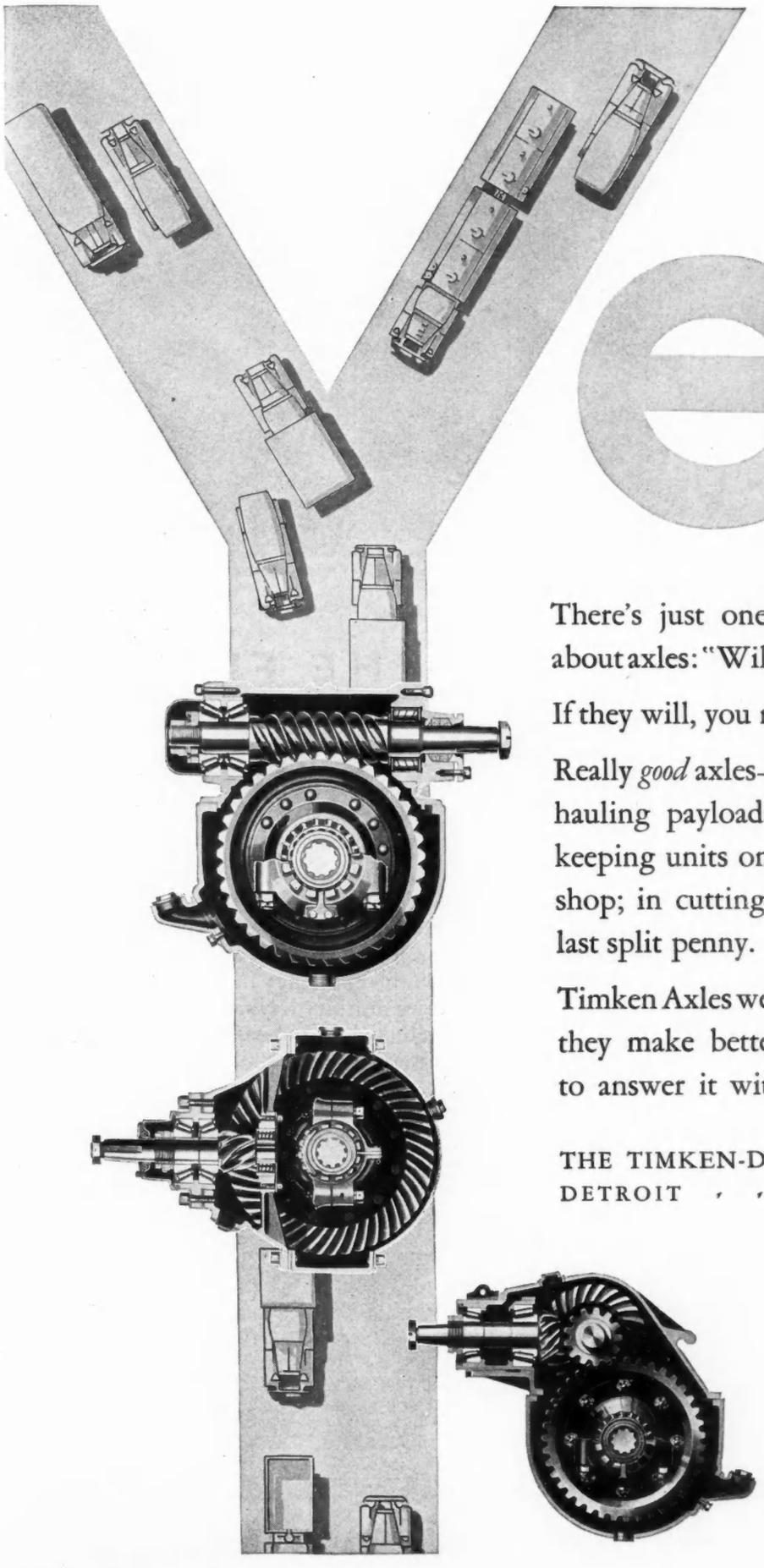
The latter involves, it is noted "a complete reversal of the intent and purpose of the Federal Trade Commission Act . . . the enforcement of which like its accompanying acts (Sherman and Clayton) "is to prevent the business world from escaping by devices of its own the alternations of the (business) cycle."

Under the scheme of Mr. Gaskill the Trade Practice Conference would have its scope vastly increased, for "it is necessary that there should be some limitation upon the regulation of competition by trade agreement to insure its conformance to the outline of public policy (which would previously be legislatively established). The indicated supervision would be administrative in character. The supervisory function of the Federal Trade Commission would then be in the nature of a veto power to be used "when the regulatory action of industry conflicts with predetermined public policy."

If experience counts for anything it must be clear that the regulatory program for industry "though originating in the majority sense of a trade or industry, must rise to the level of enforceable law for the whole of that trade or industry," according to Mr. Gaskill's view. The mechanism of this regulatory process, Mr. Gaskill believes, already exists in the Trade Practice Conference, the Federal Trade Commission, and the Federal Courts. It remains only for the underlying law to be changed, to permit proper functioning of the mechanism, and to permit a greater degree of regulated competition.

The greatest contribution to the public welfare, Mr. Gaskill concludes, "lies in the widest possible application of the cost limitation on selling price."

"And since it seems preferable that this change should be an evolutionary process, no impediment should be put in the way. It should be made quite clear in the modified law that agreements for uniform cost accounting and the maintenance of individual costs, as the minimum selling price, are in the public interest, no matter where they may appear."



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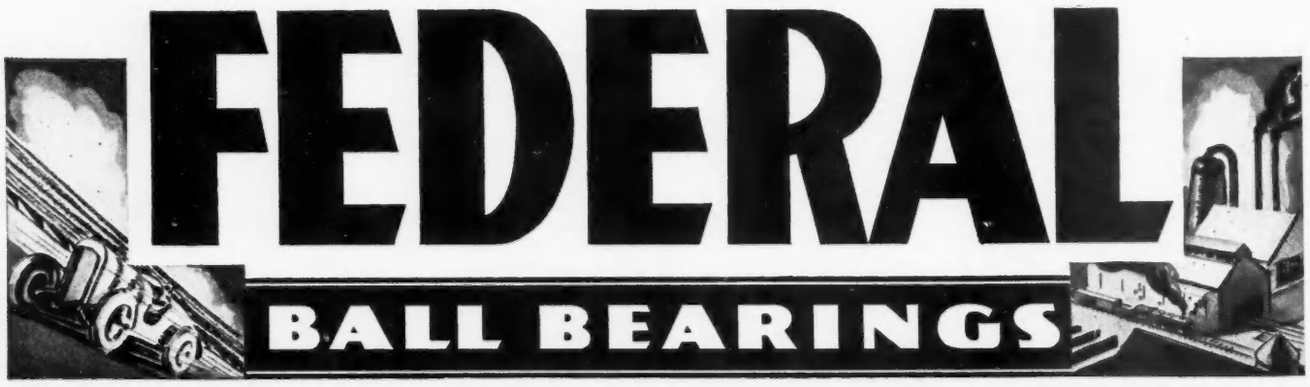

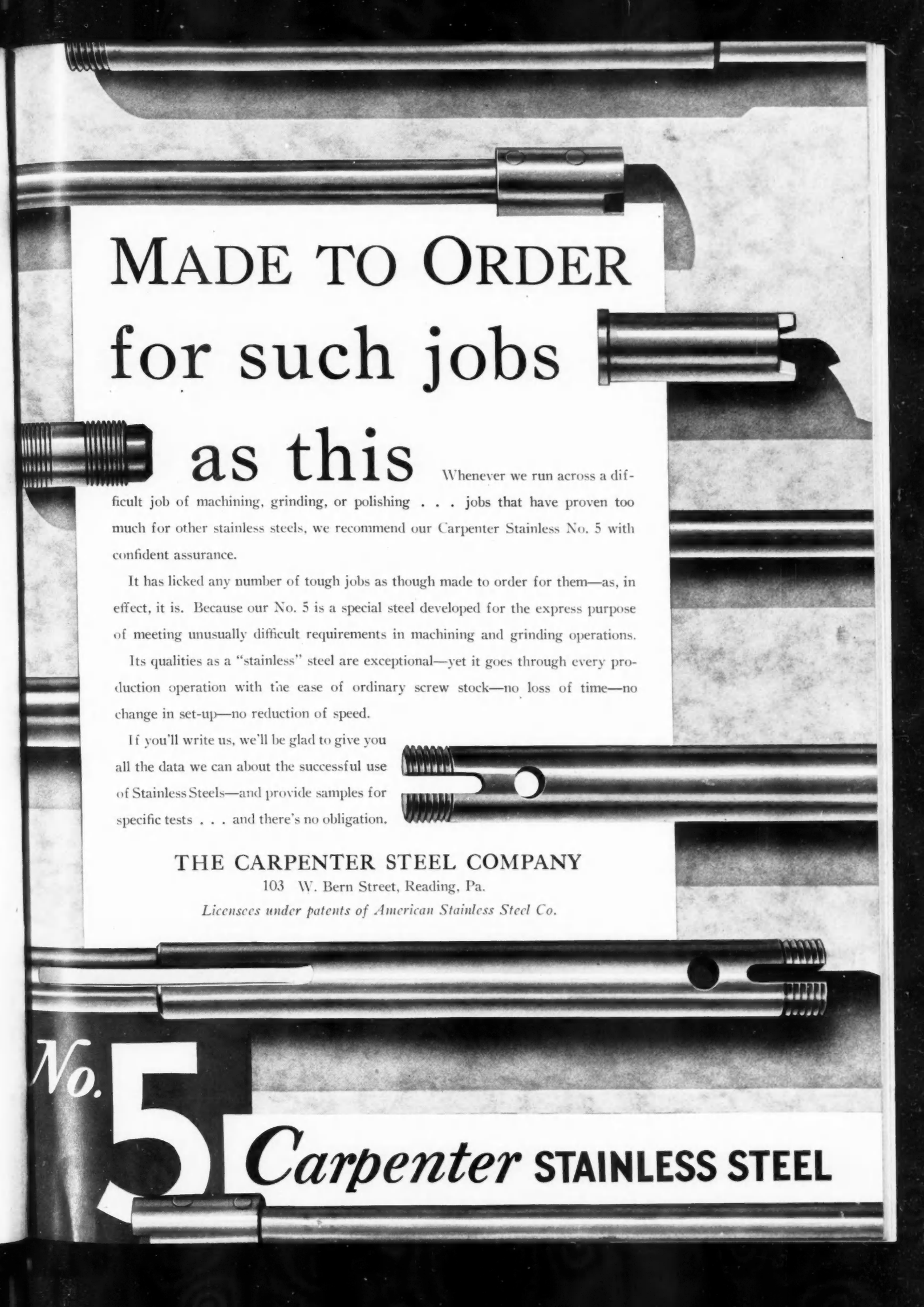

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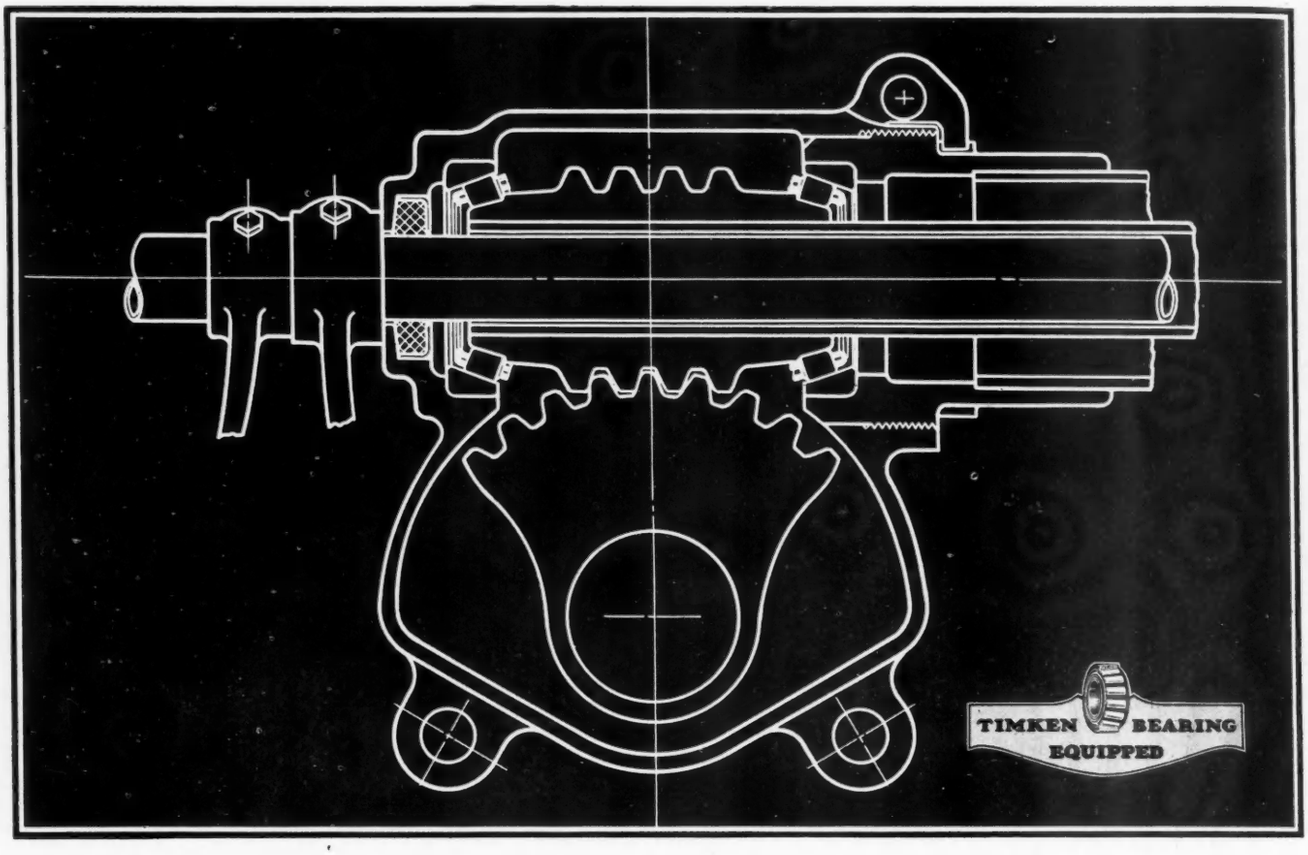


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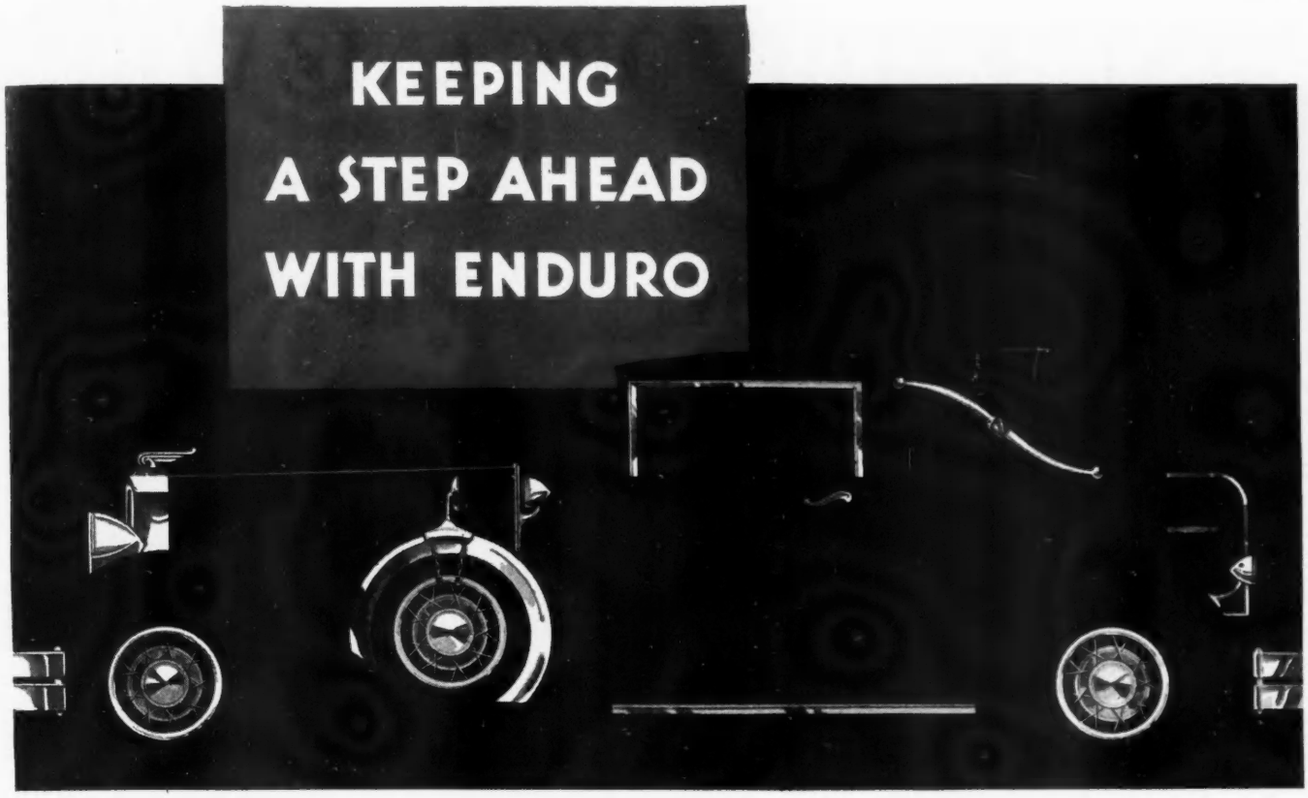


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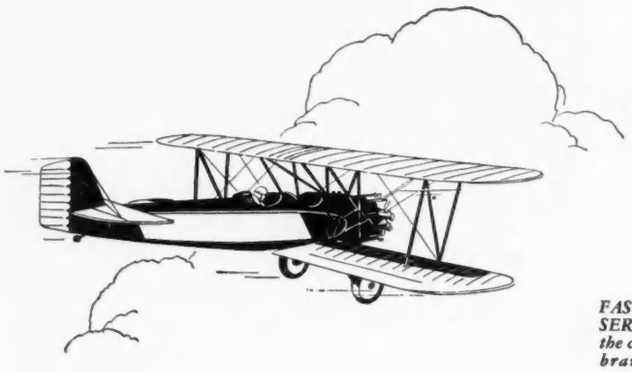

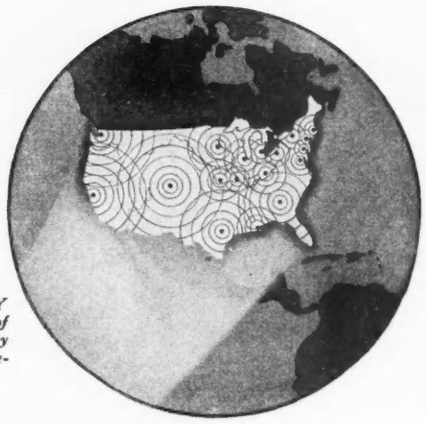

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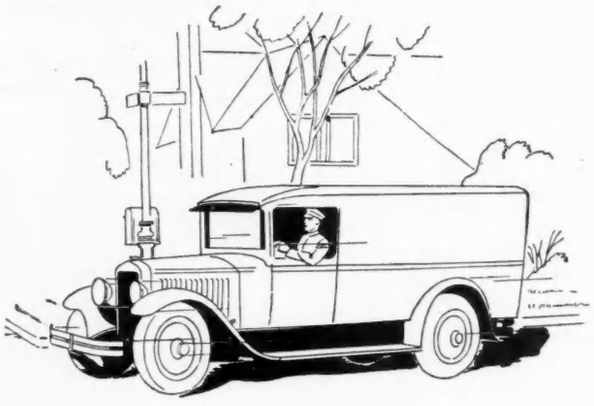

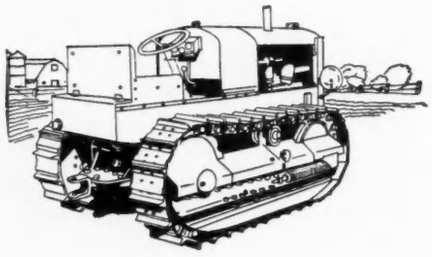

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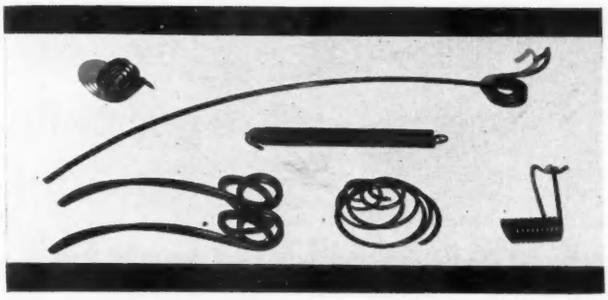
# Springs



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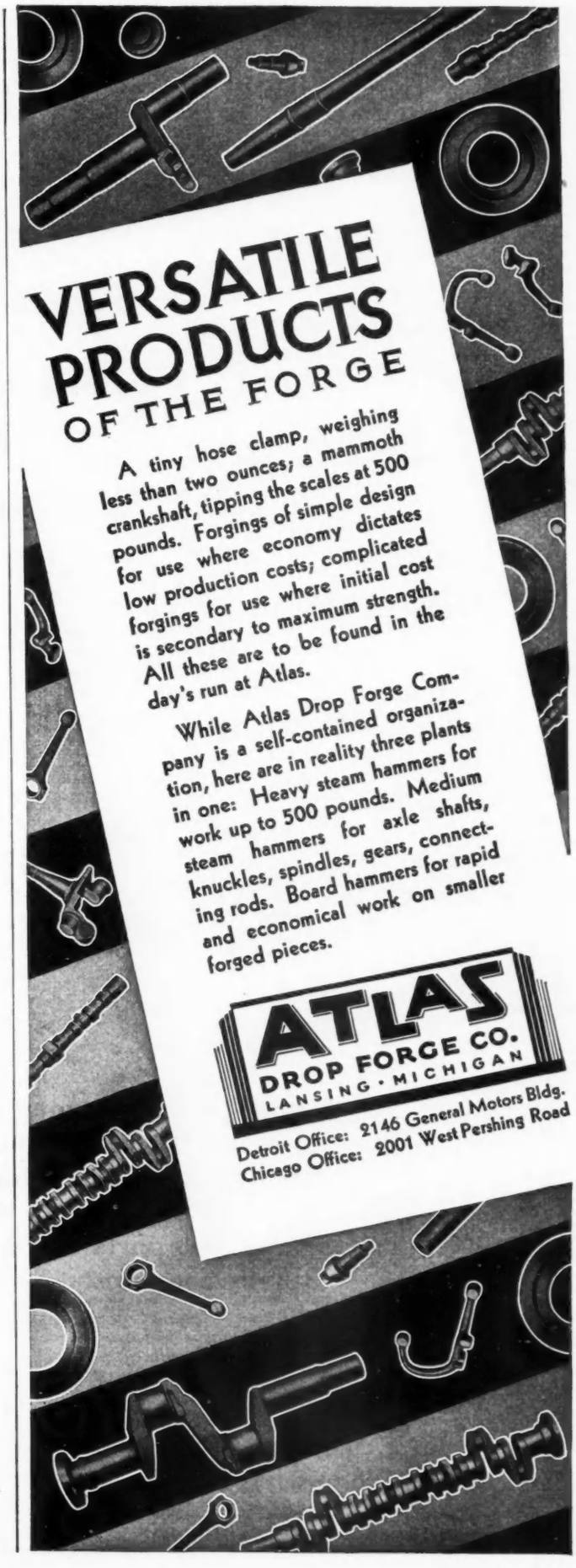

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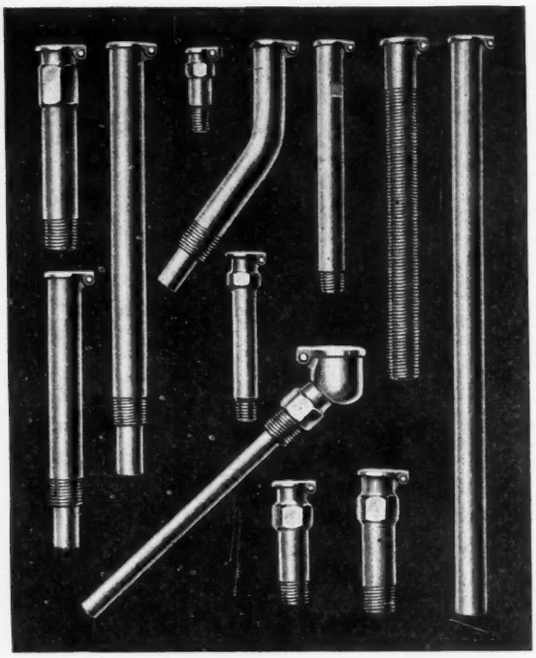

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The advertising pages of Automotive Industries are loaded with information which has direct, definite and up-to-the-minute value for you and your company.

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United Business Publishers, Inc.

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Spray-Painting Finishing System
THE DEVILBISS COMPANY TOLEDO, OHIO

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Automotive Silent Chain
*Quiet - Durable - Efficient*
LINK-BELT COMPANY - INDIANAPOLIS - DETROIT

**KONIGSLOW**
*Stampings*
Right as to price. Right on time.
*Quotations gladly furnished.*
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THE MATERIAL OF A THOUSAND USES
Standard for many Automotive Parts. In Laminated Sheets, Rods and Tubes, Cements, Varnishes, Lacquers and Enamels
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Chicago Office: 635 West 22nd Street

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— coincidental — non-forgettable — effective "one lock" protection
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COMPLETE FORGING EQUIPMENT
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THE NATIONAL MACHINERY CO. TIFFIN, OHIO
*Sales Offices*
NEW YORK, 152 W. 42nd St. CHICAGO, 565 W. Washington St.
DETROIT, 2457 Woodward Ave.

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**PITTSBURGH FORGINGS CO.**
CORAOPOLIS PENNA.
QUALITY SERVICE
WORKMANSHIP
DETROIT OFFICE GEN'L MOTORS BLDG.
CARBON & ALLOY DROP OR UPSET FORGINGS

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DRILLING, BORING, TAPPING MACHINES
Vertical and Horizontal, Multiple-Way Types.
Submit your Problem.
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In Last Week's Issue
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Cleveland, Ohio

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INTERNAL SURFACE AND CYLINDER GRINDERS
THE HEALD MACHINE CO.
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POSITIVE LUBRICATION
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For the lightest auto to the heaviest railway car.
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Also rings and bands 6" to 60" dia.
Estimates freely figured.
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Detroit Chicago Newark Philadelphia

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SPOKSTEEL WHEELS . . . STAMPINGS
LANSING · MICHIGAN

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for the Automobile Industry

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*Factories at* PORT CHESTER, N.Y. ROCK FALLS, ILL. CORAOPOLIS, PA.

*Philadelphia, Chicago, San Francisco*

*Detroit, Seattle, Portland, Los Angeles*

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**AMERICAN CHEMICAL PAINT CO.**

AMBLER, PENNA.

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FENDERS DUST SHIELDS RUNNING BOARD SHIELDS

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FIRTH-STERLING STEEL COMPANY

McKEESPORT · · · PENNA.

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Light, Medium and Heavy Stampings

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*Investigation Solicited*

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Automatic for every purpose
THE CLEVELAND AUTOMATIC MACHINE CO.
CLEVELAND, O.
NEW YORK CHICAGO DETROIT

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AND MATERIAL HANDLING EQUIPMENT
LOWER COSTS The ELECTRIC FURNACE Co. SALEM OHIO

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THE AJAX MANUFACTURING COMPANY
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Euclid Branch P. O. Cleveland, Ohio
1369 Hudson Terminal 50 Church St. New York City

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THE Acklin STAMPING COMPANY
TOLEDO, OHIO

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Chicago Warehouse: 1023-1027 W. Jackson Blvd.
Eastern Mill: Buffalo, N. Y.
Offices in Principal Cities

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METAL CLEANERS
ASK YOUR SUPPLY MAN
Retain their cleaning strength, giving longer service

CRANKSHAFTS
and
Heavy Drop Forgings
THE PARK DROP FORGE CO.
CLEVELAND, OHIO

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SHEET METAL STAMPINGS
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WORCESTER MASS.
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STAMPINGS

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## Automotive Products and Factory Equipment Manufactured by Advertisers in This Issue

See Alphabetical List of Advertisers on Third and Fourth Following Pages

This Advertisers' Index is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

**Air Cleaners**
Handy Governor Corp.
United Air Cleaner Co.

**Ammeters**
General Electric Co.

**Arms & Knuckles, Steering**
Canton Forge & Axle Co.

**Axles**
Canton Forge & Axle Co.
Park Drop Forge Co.
Timken - Detroit Axle Co.
Williams & Co., J. H.

**Batteries, Storage**
Electric Storage Battery Co.

**Bearings, Anti-Friction**
*Ball*
Aetna Ball Bearing Mfg. Co.
Federal Bearings Co., Inc.
New Departure Mfg. Co.
*Roller*
Timken Roller Bearing Co.

**Bending & Straightening Machines**
Chambersburg Engineering Co.
Chambersburg National Co.
Cleveland Punch & Shear Works Co.
National Machinery Co.

**Blanks**
*Forged*
Bethlehem Steel Co.

**Bodies**
Budd Mfg. Co., E. G.
Mullins Manufacturing Corp.

**Bolts & Nuts**
Atlas Bolt & Screw Co.
National Acme Co.
Russell, Burdsall & Ward Bolt & Nut Co.

**Boring Machines**
Foote-Burt Co.
Rockford Drilling Machine Co.

**Brake Bands**
Konigslow Mfg. Co., Otto

**Brake Drums**
Erie Malleable Iron Co.

**Brakes**
*Air*
Bendix - Westinghouse Automotive Air Brake Co.

**Brass or Copper Rod & Tube**
Wolverine Tube Co.

**Buffing & Polishing Machines**
Black & Decker Mfg. Co.

**Bulldozers**
Ajax Mfg. Co.

**Bumpers**
Stewart-Warner Corp.

**Bushings**
*Fibre*
Continental - Diamond Fibre Co.

**Camshafts**
Park Drop Forge Co.

**Castings**
*Die*
Barnhart Brothers & Spindler
*Malleable*
Erie Malleable Iron Co.
Link-Belt Co.
Timken Roller Bearing Co.
*Steel*
Link-Belt Co.

**Chains**
*Front End*
Link-Belt Co.

**Channels for Glass**
*Felt*
American Felt Co.

**Chucks, Magnetic**
Heald Machine Co.

**Clarifiers, Centrifugal**
National Acme Co.

**Cleaners, Metal**
Ford Co., J. B.
*Rust Preventive*
American Chemical Paint Co.

**Clutches**
Rockford Drilling Machine Co.

**Compressors, Air**
Bendix - Westinghouse Automotive Air Brake Co.

**Connecting Rods**
Canton Forge & Axle Co.
Park Drop Forge Co.
Wyman-Gordon

**Contact Points, Electrical**
Elkon Div., P. R. Mallory & Co., Inc.

**Conveyor Equipment**
Link-Belt Co.
Wickwire Spencer Steel Co.

**Covers, Housing**
Acklin Stamping Co.

**Crankshafts**
Canton Forge & Axle Co.
Park Drop Forge Co.
Williams & Co., J. H.
Wyman-Gordon

**Cups**
*Lubricating*
Gits Bros. Mfg. Co.
Link-Belt Co.

**Cutters**
Brown & Sharpe Mfg. Co.
Fellows Gear Shaper Co. (Gear)

**Die Cushions**
Marquette Tool & Mfg. Co.

**Die Heads**
National Acme Co.

**Dies, Jigs and Fixtures**
Marquette Tool & Mfg. Co.

**Discs, Clutch**
Acklin Stamping Co.

**Drilling Machines**
Foote-Burt Co.
Greenlee Bros. & Co. (Multiple Spindle)
Rockford Drilling Machine Co.

**Drills, Portable Electric & Pneumatic**
Black & Decker Mfg. Co.

**Enamels**
American Chemical Paint Co. (Rust Proofing)
Bakelite Corp.

**Felt**
American Felt Co.

**Fenders**
Motors Metal Corp.
Mullins Mfg. Co.

**Fibre Rods, Sheets, Tubes**
Continental - Diamond Fibre Co.

**Filters**
*Oil*
Handy Governor Corp.

**Forgings**
Canton Forge & Axle Co.
Park Drop Forge Co.
Pittsburgh Forgings Co.
Williams & Co., J. H.
Wyman-Gordon

**Furnaces, Electric**
*(Annealing, Carburizing, Heat Treating, Forging & Welding)*
Electric Furnace Co.

**Gages**
*Inspection*
Standard Gage Co.

**Gaskets**
*Felt*
American Felt Co.

**Gear Cutting Machines**
Brown & Sharpe Mfg. Co.
Fellows Gear Shaper Co. (Shapers)

**Gear Material**
*Non-Metallic*
Bakelite Corp.
Continental - Diamond Fibre Co.

**Gears**
*Timing, Metallic*
Canton Forge & Axle Co.
Link-Belt Co.
Park Drop Forge Co.
*Timing, Non-Metallic*
Continental - Diamond Fibre Co.
General Electric Co.

**Governors, Engine**
Handy Governor Corp.

**Grinders**
Black & Decker Mfg. Co. (Electric)
LeBlond Machine Tool Co., R. K.

**Grinding Machines**
Black & Decker Mfg. Co
Brown & Sharpe Mfg. Co.
Bryant Chucking Grinder Co.
Fellows Gear Shaper Co.
Foote-Burt Co.
Heald Machine Co.
Landis Tool Co.
LeBlond Machine Tool Co., R. K.
*Internal*
Bryant Chucking Grinder Co.
Heald Machine Co.
*Surface*
Bryant Chucking Grinder Co.
Heald Machine Co.
*Tool*
LeBlond Machine Tool Co., R. K.
*Universal*
Landis Tool Co.
*Valve Seat*
Black & Decker Mfg. Co.
Foote-Burt Co.

**Hammers, Power**
Chambersburg Engineering Co.
Chambersburg National Co.
Erie Foundry Co.
National Machinery Co.

**Hangers**
*Shafting*
New Departure Mfg. Co.

**Hardware, Body**
Mitchell Specialty Co.

**Heaters, Car**
Stewart-Warner Corp.

**Hobs**
Brown & Sharpe Mfg. Co.

**Hoods**
Motors Metal Corp.

**Horns**
Stewart-Warner Corp.

**Hose Clamps**
Konigslow Mfg. Co., Otto

**Hose, Flexible Metallic**
*(Radiator & Fuel Lines)*
Titeflex Metal Hose Co.

**Insulating Material**
Bakelite Corp.
Continental - Diamond Fibre Co.

**Lacquer**
Amer. Cyanamid Co. (Rezyl Lacquer Constituent)

**Lathes**
*Automatic*
LeBlond Machine Tool Co., R. K.
*Automatic Chucking*
Potter & Johnston Machine Tool Co.
*Crankshaft Turning*
LeBlond Machine Tool Co., R. K.
*Turret*
Potter & Johnston Machine Tool Co.

**Lighting Equipment, Electric**
*Factory*
General Electric Co.

**Locks**
*Ignition*
Mitchell Specialty Co.

**Lubricating Systems, Centrally Controlled**
Bijur Lubricating Corp.

**Lubricators**
*Chassis*
Gits Bros. Mfg. Co.

**Lugs**
Wolverine Tube Co.

**Machine Work**
Jackson Auto Radiator Co.
Konigslow Mfg. Co., Otto (General)

**Milling Machines**
Brown & Sharpe Mfg. Co.
LeBlond Machine Tool Co., R. K.
Rockford Drilling Machine Co.
*Universal*
LeBlond Machine Tool Co., R. K.

**Mirrors**
Stewart-Warner Corp.

**Molded or Machined Parts (Phenolic)**
Bakelite Corp.
Continental - Diamond Fibre Co.

**Motors, Electric Power**
General Electric Co.

**Pads**
*Felt*
American Felt Co.

**Paints**
*Heat Resisting*
American Chemical Paint Co.

**Pickling Compounds**
American Chemical Paint Co.

**Plugs, Expansion**
Hubbard Spring Co., M. D.

**Powerplants, Industrial**
General Electric Co.

**Presses**
Bliss Co., E. W.
Chambersburg Engineering Co.
Chambersburg Nat'l Co.
Cleveland Punch & Shear Works Co.
Erie Foundry Co.
Ferracute Machine Co.
National Machinery Co.

**Pumps, Lubricating**
Cleveland Steel Products Corp.

**Punches**
Cleveland Punch & Shear Works Co.
Ferracute Machine Co.

**Radiator Parts**
Jackson Auto Radiator Co.

**Radiator Shells**
Motors Metal Corp.

**Radiators**
Jackson Auto Radiator Co.

**Removers, Enamel and Paint**
American Chemical Paint Co.

**Rings and Bands, Welded**
Akron-Selle Co.

**Rivets**
Atlas Bolt & Screw Co.
Russell, Burdsall & Ward Bolt & Nut Co.

**Rolling Mills**
Bliss Co., E. W.

**Running Boards**
*Metal*
Motors Metal Corp.

**Rust Removers & Preventives**
American Chemical Paint Co.

**Saws**
Ajax Mfg. Co. (Hot Cutting)

**Screw Drivers, Power**
Black & Decker Mfg. Co. (Electric)

**Screw Machine Products**
National Acme Co.

**Screw Machines**
Brown & Sharpe Mfg. Co.
Cleveland Automatic Machine Co.
Greenlee Bros. & Co.
National Acme Co.
Potter & Johnston Machine Tool Co.

**Screws**
*Cap*
Atlas Bolt & Screw Co.
National Acme Co.
*Drive*
Elco Tool & Screw Co.
*Machine*
Atlas Bolt & Screw Co.
Elco Tool & Screw Co.
National Acme Co.
*Set*
Atlas Bolt & Screw Co.
National Acme Co.
*Wood*
Elco Tool & Screw Co.

**Shafting**
Bliss & Laughlin, Inc. (Turned & Polished)
New Departure Mfg. Co.

**Shafts, Axle, Propeller & Transmission**
Cleveland Steel Products Corp.
Pittsburgh Steel Prods. Co.

**Shears**
Bliss Co., E. W.
Cleveland Punch & Shear Works Co.
Ferracute Machine Co.

**Sheet Metal Machines**
Bliss Co., E. W.
Cleveland Punch & Shear Works Co.
Ferracute Machine Co.

**Shock Absorbers**
Stewart-Warner Corp.
John Warren Watson Co.

**Special Machinery**
Bliss Co., E. W.
Cleveland Automatic Machine Co.
Greenlee Bros. & Co.

**Speedometers and Tachometers**
Stewart-Warner Corp.

**Spray Painting & Lacquering Equipment**
DeVilbiss Co.

**Springs**
*Flat & Spiral*
Hubbard Spring Co., M. D.
Wickwire Spencer Steel Co.
*Leaf*
Mather Spring Co.

**Stampings**
Acklin Stamping Co.
Akron-Selle Co.
Hubbard Spring Co., M. D.
Jackson Auto Radiator Co.
Konigslow Mfg. Co., Otto
Mitchell Specialty Co.
Motor Wheel Corp.
Motors Metal Corp.
Mullins Mfg. Corp.

**Steel**
*Alloy*
Carpenter Steel Co.
Firth-Sterling Steel Co.
Illinois Steel Co.
Republic Steel Corp.
Timken Roller Bear. Co.
*Bars*
Illinois Steel Co.
Republic Steel Corp.
Timken Roller Bear. Co.
*Billets*
Illinois Steel Co.
Timken Roller Bear. Co.
*Carbon*
Bethlehem Steel Co.
Carpenter Steel Co.
Firth-Sterling Steel Co.
Illinois Steel Co.
Republic Steel Corp.
Timken Roller Bear. Co.
*Cold Drawn*
Bliss & Laughlin, Inc.
Republic Steel Corp.
*Electric*
Carpenter Steel Co.
*Electric Furnace*
Bethlehem Steel Co.
Timken Roller Bear. Co.
*High Speed*
Bethlehem Steel Co.
Carpenter Steel Co.
Firth-Sterling Steel Co.
*Shapes*
Illinois Steel Co.
*Sheets*
Bethlehem Steel Co.
*Stainless*
Bethlehem Steel Co.
Carpenter Steel Co.
Firth-Sterling Steel Co.
Republic Steel Corp.
*Strip*
Carpenter Steel Co.
Republic Steel Corp.
*Tool*
Carpenter Steel Co.
Firth-Sterling Steel Co.
Timken Roller Bear. Co.

**Steering Gears**
Ross Gear & Tool Co.

**Steering Wheels**
Acklin Stamping Co.

**Tank Suppirt Straps**
Konigslow Mfg. Co., Otto

**Tapping Machines**
Greenlee Bros. & Co.

**Thread Generators**
Fellows Gear Shaper Co.

**Tools, Small**
Brown & Sharpe Mfg. Co.
Williams & Co., J. H.

**Tubes, Axles, Steering Column & Torque**
Bundy Tubing Co.
Pittsburgh Steel Prods. Co.

**Tubing**
*Brass & Copper*
Bundy Tubing Co.
*Flexible Metal*
Titeflex Metal Hose Co.
Wolverine Tube Co.
*Steel*
Bundy Tubing Co.
Pittsburgh Steel Prods. Co.

**Turret Machines, Automatic**
Potter & Johnston Machine Tool Co.

**Universal Joints**
Cleveland Steel Prods. Corp.
Mechanics Universal Joint Co.

**Upsetting Machines**
Ajax Mfg. Co.

**Vacuum Tanks**
Stewart-Warner Corp.

**Varnishes**
Bakelite Corp.

**Washers**
*Felt*
American Felt Co.
*Lock*
Shakeproof Lock Washer Mfg. Co.
*Plain Metal*
Acklin Stamping Co.
Hubbard Spring Co., M. D.

**Welders**
*Electric*
Federal Mach. & Welder Co.
General Electric Co.

**Welding Material**
Elkin Div., P. R. Mallory & Co., Inc. (Dies for arc and resistance welding)
Wickwire Spencer Steel Co.

**Wheels**
Budd Wheel Co.
Erie Malleable Iron Co.
Motor Wheel Corp.

**Wicks, Felt**
American Felt Co.

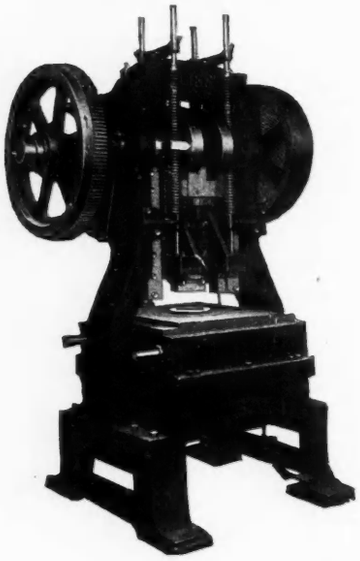
**Wire & Cable**
*Brake, Choke, Towing*
Wickwire Spencer Steel Co.

**Wire Products**
Wickwire Spencer Steel Co.

**Wrenches**
Black & Decker Mfg. Co.
Williams & Co., J. H.

# BLISS

## Don't Trim and Grind TRIM FLAT



## BLISS FLAT EDGE TRIMMERS

**To trim quickly and accurately a simple straight edge or an irregularly notched edge, to do this in a single operation, and to accomplish it with dies which are simple in principle, has proven practical, easy and highly economical, in Bliss Flat Edge Trimmers.**

**A punch on the press slide enters the article to be trimmed and is held accurately in position with reference to the cutting edge of the outer die in which the article is set. A floating pad on the punch determines accurately the height to which the article will be trimmed. In operation the article is placed in the die, the punch descends locating the inner and outer cutting edges, and a slight front and back, right and left motion is imparted to the die which is carried in compound slides in the bed of the press. There results a level and square sheared edge without joint marks or deformation.**

***"Bliss" on your machinery is more than a name; it's a guarantee.***

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**INCREASING** numbers of purchasing agents have learned that **"for true screw economy, order from Elco"** has become the eleventh commandment of the industry. It's one of those infallible laws that costly experience has proven to be the preferred practice where dependable results are required. Elco Screws are available in any desired commercial finish to meet individual requirements.

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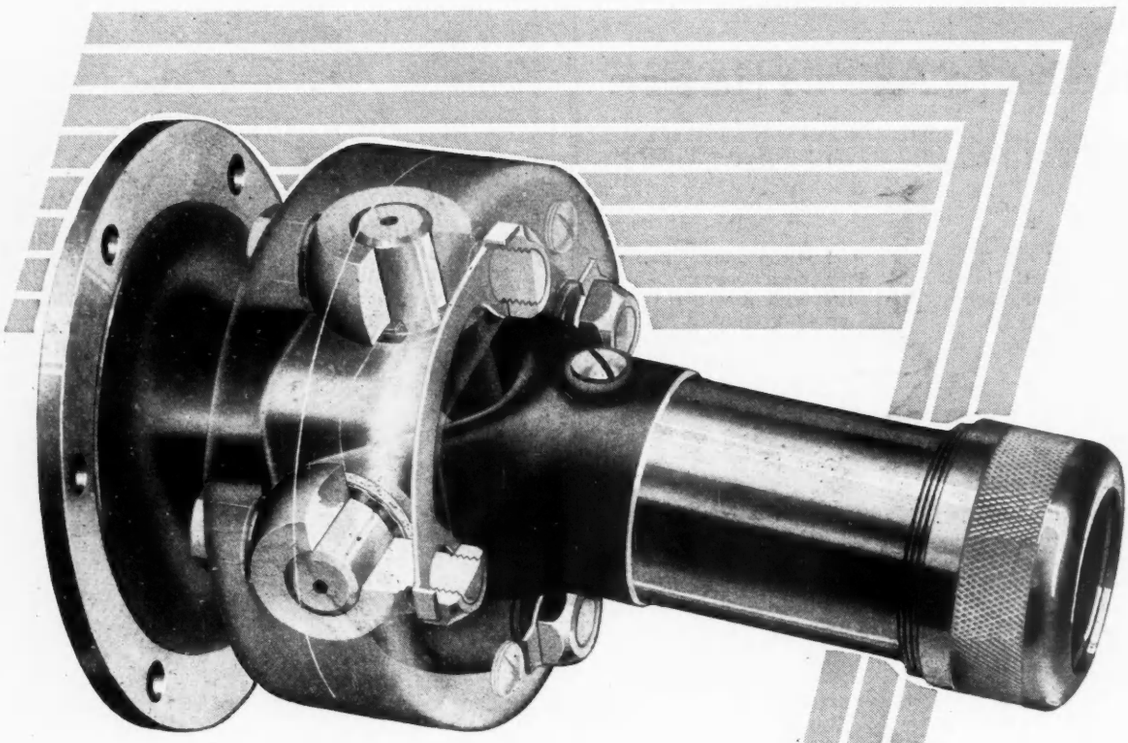
**Machine Screws**
**Wood Screws**
**Machine Screw Nuts - Drive Screws - Cap Screws - Pipe Plugs - Lag Screws - Upset Products and Service**

ELCO TRADE MARK ROCKFORD

ELCO SCREWS



DESTRUCTIVE abrasives, dust, dirt, silica and other harmful particles encountered in cities and rural districts emphasize the absolute necessity of dependable protection of the moving parts on modern cars and trucks.

Mechanics Universal Joints are so designed and constructed that destructive abrasives are shut out and the lubricant is kept in. Oil . . . the effective lubricant . . . will not congeal . . . it assures perfect lubrication of the vital parts. Mechanics Universal Joints are "Oil Lubricated —Oil Tight" . . . and Mechanics retain the lubricant. That's the secret of the increasing popularity of Mechanics Universal Joints.

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ROCKFORD, ILL.

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# MECHANICS
"OIL LUBRICATED—OIL TIGHT"
# UNIVERSAL JOINT

# Your requirements in view

# at every step of manufacture

In the manufacture of alloy steels there are many factors which, though having a marked influence on the suitability of the steel for any given purpose, are not and cannot be covered by specifications, as no recognized standards for their measurement exist. It is because of this fact that the experience gained through Bethlehem's close cooperation with alloy steel users since these steels first came into use is invaluable in making alloy steels that can be depended upon for the best results under any given conditions.

Each operation in the manufacture of Bethlehem Alloy Steels is controlled with a view to giving the consumer the fullest possible measure of satisfaction both in behavior under the processing in his plant and in length of life in service. As the men responsible for the quality of the steel have a broad knowledge embracing both the user's problems and problems of manufacture, they are in a position to swing the more or less intangible properties in such a direction that they all contribute to the one result—the right steel for the purpose.

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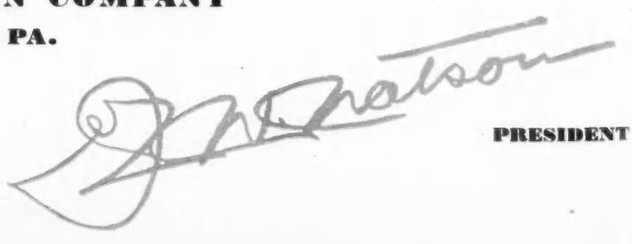
When tested by hand, most any shock absorber shows itself to be "on the job" with plenty of resistance right from the beginning of the recoil or downward movement of the arm. That is because the upward movement of the arm has been slow enough, by hand, to enable atmospheric pressure to cause the oil to follow the piston, thus filling the chamber completely before the recoil or downward movement of the arm is started.

But how about this filling of the chamber when flashing over bumps at fifty miles per hour? Does the wanting chamber get filled and re-filled in each of those flashing split seconds? Right there is the rub, and also the reason why many *apparently* efficient devices fail so utterly when put to the test on an automobile at normal speeds over normal roads.

If you are interested in flash action, "nip it in the bud", real control at *any* speed, look into the exclusive Supercharging feature of the new Watson Hydraulic Shock Absorber.

**JOHN WARREN WATSON COMPANY**
**PHILADELPHIA, PA.**



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